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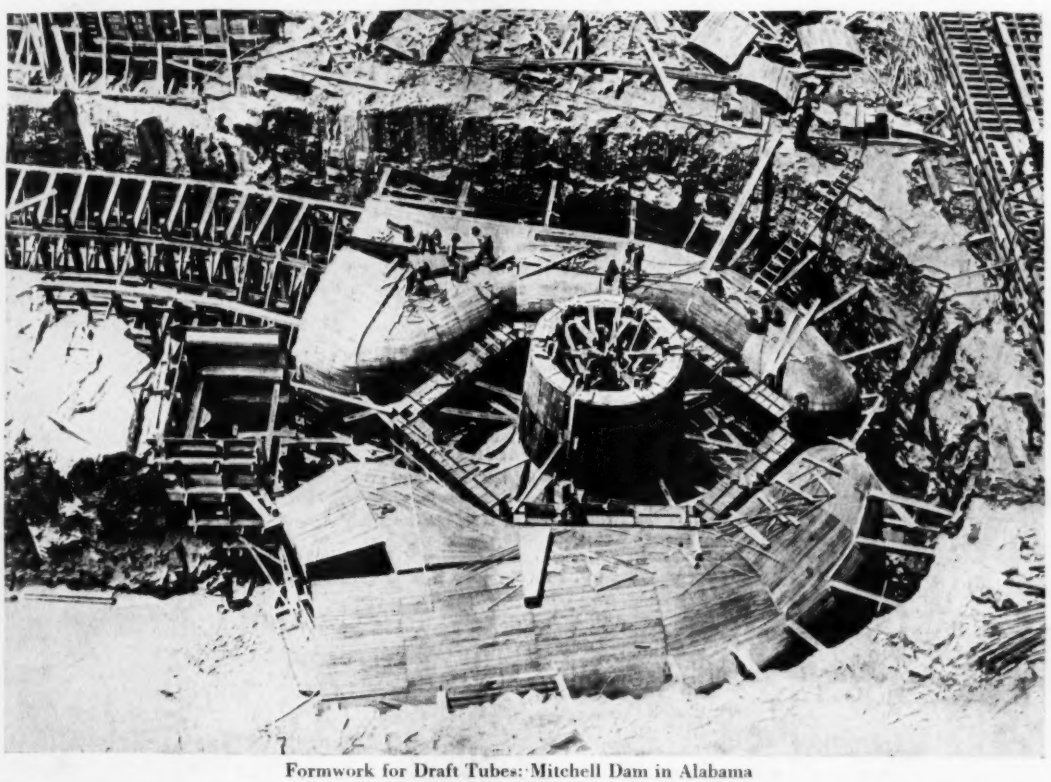
Engineering News-Record



Formwork for Draft Tubes: Mitchell Dam in Alabama

Staff Report on New England Water-Works Convention

Highway Development by the Alaska Road Commission

Constructing the Mitchell Dam on the Coosa River

Utilization of Methane Gas From Imhoff Tanks

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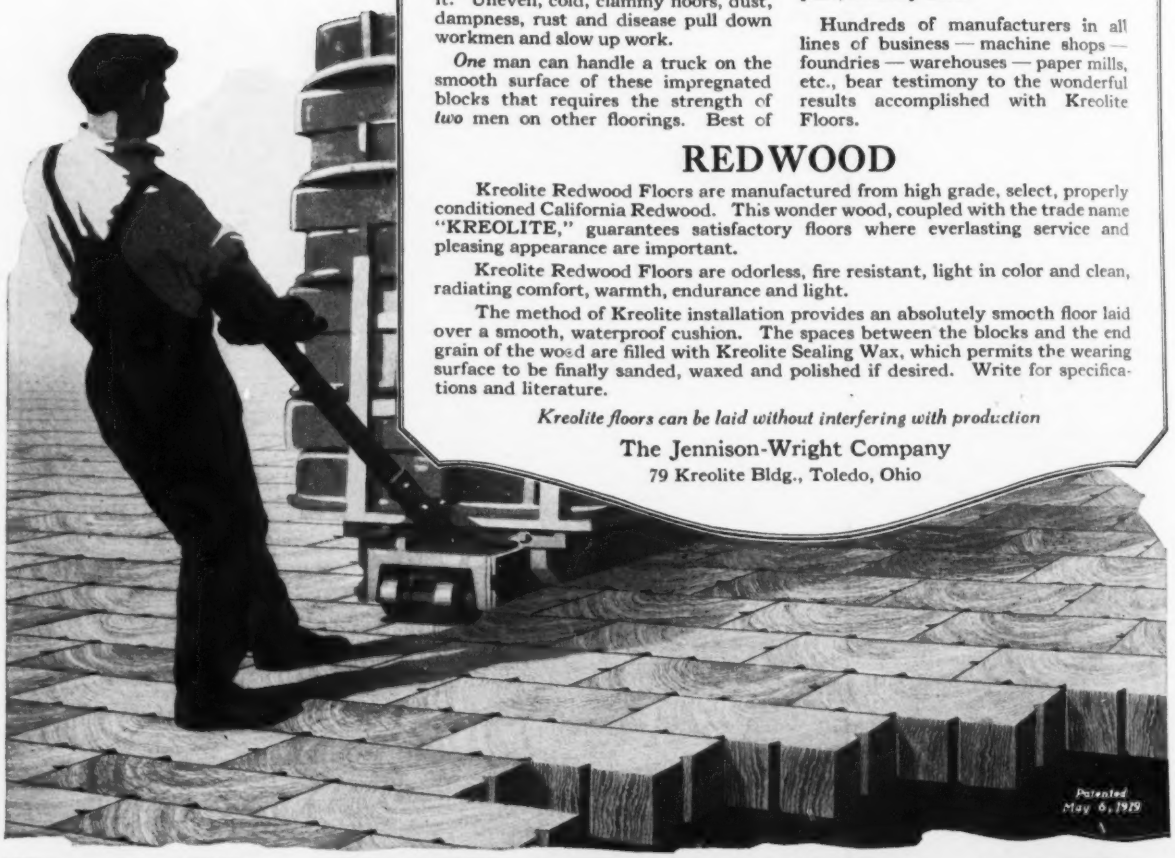

FLOORS

WOOD BLOCK

A Consolidation of Engineering News and Engineering Record — McGraw-Hill Company, Inc.—JAMES H. McGRAW, *President*

ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. MEHREN, *Editor*
FRANK C. WIGHT, *Managing Editor*

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Local vs. National Society

THE decline of one-fourth in the membership of the New England Water Works Association in the past seven years, mentioned in the address of the retiring president last week, must be a matter of concern to the officers and others who have the welfare of the organization at heart. It is true that the 769 members as of Sept. 1 is a goodly number for an association which recruits its ranks chiefly from a small section of the country; but the members could once truly say that the "New England Water Works Association is local in name only." It is still largely true. That it is not so markedly true now as formerly is due in part to the strenuous efforts of recent years to make the American Water Works Association a large and thoroughly representative national organization, with sectional branches, both geographical and technical. Perhaps men who are members of both organizations have put so much of their time and strength into the American Association for the past few years that they have unwittingly robbed the New England Association. The situation deserves careful study by all the friends and supporters of both organizations, for neither is going to gain materially and permanently through the decline of the other.

A Construction Safety Code

DISCUSSION of the proposed safety code for construction work, which will be taken up by the Construction Section of the National Safety Council at the meeting next week in Buffalo, N. Y., should be active. Following factory practice, construction organizations have in a few years made remarkable progress in accident prevention. In the beginning the effort was largely individual and it is still confined too largely to a comparatively small number of progressive constructors. Group effort was made possible by the organization six years ago of a construction section of the National Safety Council and, although the work of the section has been handicapped by inadequate support by builders and general contractors, it has, with a few loyal members, done much good. This year's meeting should witness a change. Contractors should become members. The expense is small, the encouragement to a good object will be great, and the benefits derived through the service of the national council will repay all the efforts and money expended. It is particularly timely to join in the section work now that the American Engineering Standards Committee is formulating the comprehensive safety code just ready to be presented for discussion and revision. In this code the engineering contractor has for the first time a manual which will guide him and his superintendents and foremen in planning the safety measures best suited to the particular operations in which he is engaged. Indeed it is wisely the purpose of the code not to give the builder or the sewer contractor a "set of rules" to nail to his field-office door. Full accident prevention efficiency is had only when the superintendents and foremen are induced to do constructive thinking in devising safety measures. Knowing the sources of danger, which it is the duty of the employer to give him, the man who has working crews and specific operations to direct develops remarkable efficacy and constructive pride in devising safety methods.

Keep Cars Full Loaded and Moving

ALMOST every week the railroads are establishing new records for cars loaded, for the average load per car, and mileage per car per month. How much of this improvement in service is due to increased and improved facilities it is impossible to say but it is quite certain that a large part of it is due to efforts of the American Railway Association, spurred on by the expressed public dissatisfaction with the railway service of the past few years. The association's realization of the need of drastic improvements in the service culminated in the inauguration last spring of a movement to improve the car and locomotive performance throughout the summer months in order to have the railroads in the best possible condition for the rush of the fall and early winter. Responsibility for the success of their plan rested largely with the railroads but no small part of it also rested with the shippers and consignees in loading or unloading and releasing cars promptly. There is every indication that both parties have done their part well and that the country would have gone into the rush season with something approaching the required number of cars, but for the three weeks' cessation in anthracite mining. This will increase the peak of the demand for cars in the ensuing months and the railroads will be hard pressed to meet it. The situation is one which requires hearty co-operation with the railroads by everyone who has anything to do with the shipment or loading of freight. It can be met if cars are loaded to capacity, loaded promptly and released as soon as possible after reaching their destination.

Engineering Trail Making

ROAD building in Alaska is pioneer engineering in almost its bleakest aspects. As described by the head of the Alaska Road Commission in this issue, two-thirds of the nearly 7,000 miles of Alaskan roads are trails for dog-teams and pack-trains. The distinction between this trail making and the Wilderness Trail of Daniel Boone or a dozen other historic trails of the pioneer days of America is that the development and maintenance have been under engineering direction. The Indian and the buffalo had more to do with the location of the trail which Boone and his axmen cleared across the mountains than did the engineer. Its maintenance was the concern of no one and least of all did it have the attention of engineers. It is perhaps in the

respect of maintenance that Alaska's 4,500 miles of trails stand out most distinctly. In mentioning trail maintenance nothing of course of the character of road upkeep in the States, even the dirt road states, is in mind. It means little more than that defined trail is made a little more clearly defined and easily traveled each year and is being thus progressively developed into wagon road. With a not much greater yearly expenditure for its whole mileage than many Eastern states have put into a score of miles of paved road construction, the engineers of the Alaska commission are developing a real road system which each year puts a little less hindrance on travel and each year is a little more open to the use of modern vehicles. This is highway engineering of the highest quality from which engineers working under better conditions should not withhold praise.

Inspection From the Outside

IN ONE of our large cities the dealers in reinforcing steel have taken a novel method of improving the practice in reinforced-concrete construction, with the idea that every poorly built structure is a detriment to their business and every well built one an advertisement. They have put into the field a number of traveling inspectors who go from job to job and check up the steel used against the amount called for on the drawings. Some of the contractors have resented this as an unwarranted intrusion into their business but the steel people have been backed up by the owners and engineers and have proved to their own satisfaction that the scheme pays as a preventative against skimpy construction. The idea might well be adopted by the cement companies. It is too true that the rules for good concrete making are not observed by many who should realize their necessity. This includes engineers as well as contractors. An outside agent might well observe infractions which when reported and emphasized would be remedied, though in the routine of construction and inspection they would be passed over. Every poorly built concrete structure is money out of the pocket of the cement industry. That industry is spending great sums to spread the knowledge of how to make good concrete. It might well spend a little more in the wider application of the experiment of "butting in" on specific jobs with a view to specific improvement in practice.

Building Methods Primitive

THERE has been less development of the small labor-saving machine in engineering construction than is to the credit of either the constructor or the equipment manufacturer. Equipment for mass operations, as the steam shovel and concrete mixer, has been advanced far in mechanical perfection and in employment. So have special machines like the trench excavator and the paving mixer. It is in machines for individually small operations that development has lagged. Building construction, which is pronouncedly a series of non-continuous processes of great variety, furnishes a particularly good example. Except for the high development of pneumatic tools in steel erection, we find very few light-task, labor-saving machines used. Carpentry, plastering, painting are, most commonly, hand operations on large buildings and are always manually performed in residence and other small building work. Why should acres of plaster in a modern large office or commercial building be put on with hand trowels and other acres of painting be a pail-and-brush operation? Why should yards of concrete floor be laboriously smoothed with hand floats? It is not beyond inventive skill to device usable tools. Indeed we already, it would appear, have the elements of successful tools in the cement gun, the sand blast, the paint sprayer and the wooden floor finisher.

All the backwardness does not, however, lie with the equipment manufacturer. Neither the contractor nor the artisan has progressed much beyond primitive thought in conducting many building operations. It does not seem possible for them to project their imagination beyond the hod and trowel in plastering or the bristle brush as a means of applying paint. Perhaps this is provocative speech, but that is exactly what the building contractor and his workmen deserve. In speaking publicly recently of his industry one of the most prominent building contractors of the country said: "In the building industry alone, among leading industries, primitive methods still prevail." Again he said: "The high cost of building is traceable to the lack of progress in the building industry toward developing improved methods." Indeed a little more ingenuity exercised by builders in devising new machines and methods and a little less in inventing subterfuges for constructive thinking would greatly help present building conditions.

Specializing by Proclivities

DURING this season thousands of young men are entering our engineering schools, there to start or to renew a task which each expects will lead him to eminence in the engineering profession. Fortunately for them, perhaps, they are not much concerned with the efficacy of the courses which are laid out for them to pursue. They want to become engineers, and having selected from a narrow choice the particular kind of engineer they want to be, their job is merely to complete the provided program to the best of their ability. The profession—and the educators—know that the problem is not so simple; that engineering has diversifications not at all expressed in the diversifications of the college courses, and that not a few of the troubles of the engineering profession are due to the misfits who are in it. How best to fit the individual proclivities to the prospective job is one of the most engaging problems ahead in engineering education.

Two opposing methods of doing this should be noted. One is in practical operation in many universities; the other is only a proposal. The actuality is a growing tendency toward a basic course which comprises the fundamentals of engineering and through which all varieties of engineers must pass. Having concluded this, the individual by that time trained in thought and competent to judge his own proclivities and capabilities, may select the specialty which he is to follow either in post-graduate school or in the harder school of experience. The proposal is the one made at the Ithaca convention of the Society for the Promotion of Engineering Education by Professor Bennett, of the University of Wisconsin. This suggests a functional division of engineering courses to take the place of the present industrial divisions. Instead of training a boy to be a civil, an electrical, or a mechanical engineer,

direct his studies toward the functional divisions of engineering — research, design, supervision, management, sales. While all of these would have necessarily a certain few fundamentals in common, the type of instruction would vary with the type of activity to be followed.

Each of these methods recognizes the difference in individuals and endeavors to prevent the errors which result from fitting square pegs into round holes. The distinction is that the one basic course depends on a system of natural selection, while the functional courses depend upon some artificial method of predicting the individual's bent. As the science of psychology stands today, the former seems more reliable. At some future time the psychologist may be able to solve this problem for us. It may be possible by some system of test to determine what bent the individual boy should pursue—whether he will make a better salesman than a bridge designer, or a better manager than a testing engineer. That day is far off and when it comes, if ever, there will always be the right of free individual choice to counteract some of its benefit. Professor Bennett recognizes, we think, these difficulties, not only in the exact assignment of subjects to meet his requirements, but more especially in the determination of proclivities. But the growth and development of engineering make such a proposed system of instruction most attractive and worth studying. Certainly, if there is any way of ascertaining what the boy should do, either of the two schemes should turn out more definite minded engineers than the current scheme of accepting a boy for study in some industrial branch of engineering with the details of which or the requirements for which he is only vaguely acquainted.

A further opportunity for specialization of training exists in the lower ranks of engineering. There is a great deal of such engineering that does not require four years in a technical school. Many men who cannot afford that much time or the money it entails would be just as well fitted for the practice of this kind of engineering by shorter and more specialized courses. They would be satisfied to spend their lives in the practice of what to other men who have greater ambition or capabilities would be drudgery. The man and the job would be fitted together to the satisfaction of both, and the man who with elementary training rose above the elementary job would be just that much ahead. Much of the current discontent with engineers pay is justified but there are many so-called engineers who are doing work that does not call for higher engineering ability and who are not entitled to any greater reward than they receive. Either they should never have gone into engineering in the first place—many a good bricklayer is running a transit—or they should have gone into it with a limited training which would not have promised them more than their capabilities could fulfill.

There are those engineers who see in the few short term schools that exist a menace to the profession. Properly used they are far from that. If they do not promise to turn out a professional engineer, one competent by his training to rise to any engineering responsibility, they serve a very useful purpose and should be encouraged because they may help to do what should be the ultimate aim of all engineering schools—to provide instruction in accordance with and in proportion to the student's proclivities.

Moral Suasion to Cheapen Coal

THERE is no simple solution of the problem of producing coal at fair prices, for fair wages and at a fair profit. That is the conclusion of the final report of the now defunct Federal Coal Commission. After eleven months of strenuous endeavor and after spending over half a million dollars the best the commission can do in the way of remedy is to suggest certain procedure on the part of the government, the industry itself and the public which, it is hoped, will in time cure the complicated disease that hampers all industry and disturbs every citizen. The essence of the conclusion is that it will take time to effect a cure. In the process the government must relax its inhibition on industrial combination and must insist on the public recording of statistics of production and cost, the industry must reform its methods of doing business at least to the degree of making its worst members conform with the practices of the best, and the public must learn to use anthracite substitutes and as a local issue control the cost and mechanics of distribution.

That the report will be disappointing to the public at large cannot be denied. It has been hoped that somehow the commission would find a direct way of preventing the rising cost of fuel and the recurring controversies that spell shortage. It is evident from the voluminous chapters of the report already issued that the complications of the problem are so great that the six men making up the commission can come to no agreement either as to specific blame for the past or specific improvement in the future. Anyone reading those reports will appreciate the difficulties in reaching a decision but the fact remains that the public wanted a decision and will be disappointed that none has been made.

To use the vernacular, the report hasn't the punch. It preserves a fine impartiality of view which was most necessary for the ascertainment of fact but which is most trying when expressed in the excessive verbiage of the conclusions. A few stronger expressions of opinion—even though they had to be divided—would have gained for the report the publicity which now it probably will never receive, and in that respect it will fail in one of the principal things it purposes to do, that is to teach the public how it can prevent future disturbances in the coal industry.

On the other hand the report will probably have a salutary effect on the industry itself. Provided Congress agrees with the commission, the industry will hereafter keep open books and will be taxed out of its excess profits, it will have available a mass of information regarding itself of unprecedented volume and accuracy and, best of all perhaps, it will be forced by fear of future government action to clean house, knowing full well that the dirtiness of that house is now a matter of public information. These are, to be sure, merely moral impositions, so that we will be able in the next few years to see to what extent moral suasion can control a private business which, as the commission points out, economically affects the public interest though the legality of such an assumption may well be questioned.

The net result of the work of the commission will be that for some years the coal industry will continue to have the public at its mercy. That, we repeat, is a disappointing end to a promising beginning, however much that end was inevitable.

Constructing Mitchell Dam on the Coosa River

Electric Traction on Narrow-Gage Tracks—Eight-Inch Stones Run Through Concrete Mixers—Unusual Supports for Deck Forms—Complicated Forms for Hydraucones

By L. V. Branch
Resident Engineer, Alabama Power Co., Verbena, Alabama

MITCHELL DAM is the second large development of the Alabama Power Co. on the Coosa River, in Alabama. The first development, the Lock 12 plant, placed in service in 1914, operates under a normal head of 70 ft. and has an installed plant capacity of 110,000 h.p. The new plant, here described, is located 13 miles lower down the Coosa River and also develops a 70-ft. head, backing the river up to the elevation of the tailwater of the Lock 12 plant. Other proposed developments will ultimately make use, for power purposes, of practically the total fall and regulated flow of the Coosa River and, by construction of locks at the various dams, will connect the upper navigable section of the Coosa River with the Alabama River, which is now navigable from Montgomery to Mobile Bay.

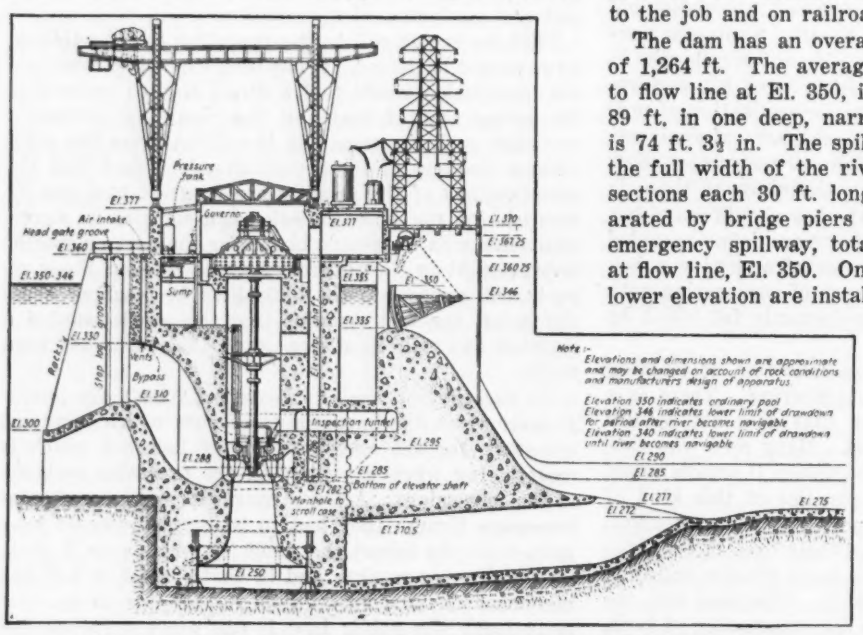


FIG. 1—SECTION THROUGH DAM AND ONE UNIT OF TOWER PLANT

In this development each unit of the power plant is located in a separate concrete tower placed upstream from the dam. This design, shown in Fig. 1, results in very short penstocks but comparatively long draft tubes. These draft tubes, passing under the dam, discharge at the downstream toe. Surplus water, during flood periods, passing over the dam removes the high tailwater from over the draft tube discharge openings, thus increasing the effective head on the plant. This "backwater suppressor" was described by J. A. Sirnit, designing and electrical engineer for the Alabama Power Co., in an article in *Engineering News-Record*, June 8, 1922, p. 966.

The plant is designed for four units of the suppressor type and for one unit of the conventional type to be located at the west end of the dam, a total ultimate installation of 120,000 h.p. At present foundations have been constructed for four units. Three of 24,000 h.p. each, a total of 72,000 h.p., have been installed. The turbines are single-runner, vertical-shaft, concrete casing turbines designed for normal operation at 100 r.p.m. under 70-ft. head, controlled by oil-pressure type governors. The vertical shafts, in 3 sections and 25 in. in diameter, have an overall length of 83 ft. The generators are of 100-r.p.m., 6,600-volt, 3-phase, 60-cycle type and have a maximum rating of 20,000 kva.

The application for a license for this plant under the Water Power Act was filed with the Federal Power Commission on Nov. 3, 1920; the license was granted June 27, 1921, and work was started immediately thereafter on the construction camp, power transmission line to the job and on railroad connection.

The dam has an overall length, including abutments, of 1,264 ft. The average height of the dam, river bed to flow line at El. 350, is 73 ft., and maximum height 89 ft. in one deep, narrow channel. The base width is 74 ft. 3½ in. The spillway, of ogee section, occupies the full width of the river channel and consists of 26 sections each 30 ft. long, with crest at El. 335, separated by bridge piers 6 ft. wide, and 5 sections of emergency spillway, totaling 150 ft. long, with crest at flow line, El. 350. On the 780 ft. of spillway at the lower elevation are installed 26 tainter type gates 15 ft. high and 30 ft. long. These gates are operated through clutches by individual motors for each pair of gates. The gate operating motors are installed in recesses in alternate bridge piers. These 6-ft. bridge piers are 34 ft. in height, the deck of the bridge being at El. 370, or 20 ft. above flow line.

The maximum flood recorded for this stretch of the Coosa River is 175,000 sec.-ft. This flood can be passed at Mitchell Dam by operation of the spillway gates, without raising the pond level. The dam is designed for maximum high water 4 ft. higher, that is, with 19 ft. of water over the main spillway and 4 ft. over the 150 ft. of emergency spillway. At this stage 300,000 sec.-ft. will pass the dam; a flow of 30½ sec.-ft. per square mile for the 9,827 sq.mi. of catchment area.

The dam contains no sluices. Fig. 1 shows normal section of spillway and section through power house.

Railroad Connections—The site of the dam is about 35 miles due north of Montgomery and within 7 miles of the main line of the Louisville and Nashville R.R running between Montgomery and Birmingham. Railroad connections with the L. & N. R.R. were made at Coopers station where yards with suitable switching tracks and storage tracks for 40 cars were constructed. Track scales were installed at this terminal and two warehouses, with a combined capacity of 7,000 bbl. of cement, were erected.

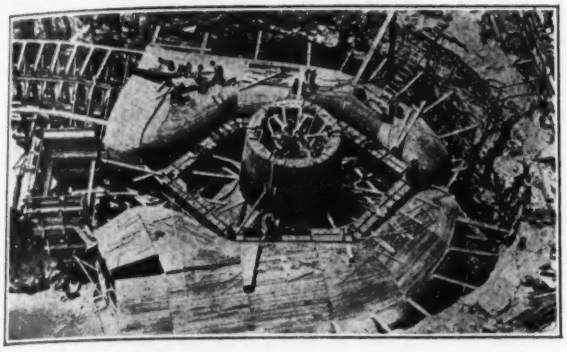


FIG. 2—ASSEMBLING FORMS FOR DRAFT TUBE OF UNIT

The railroad to the dam had a main line length of 8 miles, with an additional mile of spur tracks at the dam. These standard-gage tracks at the dam extended past the warehouses and cement and sand storages to a point under the cableways at the west end of the dam at high level, and the line was later extended out on the bridge over the dam, and to the quarry. It did not reach the river level at the dam site, for all construction tracks on the low level were narrow gage.

Camp—On account of the distance from the job to the nearest towns, it was necessary to provide camp accommodations for practically the full force required by the work. During the period when the maximum force was required, the camp had a population of 2,000.

The power company owned about a square mile of land at the west abutment of the dam. This area was a series of sharp ridges, separated by draws leading to the river. These ridges and valleys provided sightly, well drained locations for the segregation of the various sections of the camp, although the rough topography and spreading out of the camp greatly increased the cost of road construction, water supply and maintenance of camp.

The ridge nearest the dam was occupied by the main white camp and service buildings. A higher ridge above this camp was occupied by twenty-four comfortable cottages for white families and a well equipped hospital with normal bed capacity for fifteen patients. The hospital often cared for twenty patients at a time.

The negro camp, covering an area of 32 acres, was separated from the other camps and surrounded by a 10-ft. wire fence to prevent trespassers entering the camp. The gates in this fence were never all locked nor guarded, but they concentrated entrance to the camp at points under easy observation. To care for gangs of new negro laborers shipped in to the job, there were provided a mess hall, bath house and six 24-men bunk houses. For negro families, 20 two-family houses and one hundred and eighty 10 x 14-ft. shacks were erected. All these shacks were equipped with double bed, with spring and mattress, and cast-iron laundry heater. There was always a waiting list of men who wanted a shack for a family, or a group of men who wanted a similar shack as a bunk house. These small shacks proved one of the best investments in the camp facilities. A filtered water hydrant was provided for each group of eight or twelve of these houses. The negro camp was also provided with a billiard hall and a dance hall, for in order to hold large forces of negro labor it is necessary to provide amusement and quarters for the families.

The company sold building materials at cost to white employees who wished to erect small frame houses or tent houses for individual use, provided connection for electric lights and water and handled the sanitary work for the camp without charge. That portion of the camp which will be used by permanent operators of the plant was provided with sanitary sewers. In the balance of the camp the dry closet can system was used, the cans being changed daily or on alternate days, as necessary. Excellent results were secured.

The camp water supply was pumped from the river to a settling tank where alum and soda ash were added when necessary, filtered through gravity sand filters, chlorinated and then pumped to storage tanks. Water samples were taken at frequent intervals and sent to a commercial laboratory for analysis. This water supply plant gave excellent results.

Plant layout—Preliminary studies of plant requirements were based on placing 200,000 cu.yd. of concrete in fifteen months. While this made an average rate slightly in excess of 500 cu.yd. per working day, the progress schedule provided for placing double this

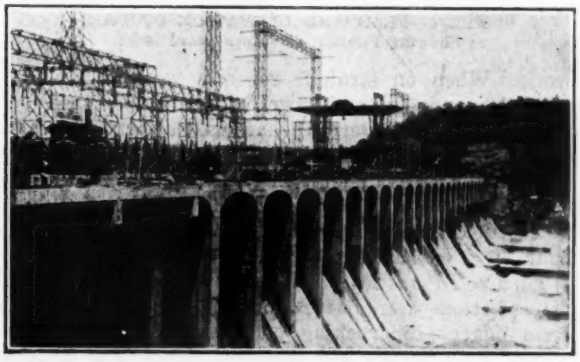


FIG. 3—GENERAL VIEW OF DAM AND BRIDGE

quantity for considerable periods, or a maximum of 30,000 cu.yd. in one month. The rock crushing, mixing and placing plants were designed for a maximum rated capacity of 100 cu.yd. of concrete per hour. The actual maximum rates of placing concrete were 1,743 cu.yd. for a two-shift day, 9,050 cu.yd. for a seven-day week and 35,476 cu.yd. during the month of November, 1922.

For concrete placing, the equipment selected was stiff-leg derricks with 60-ft. booms and two 10-ton traveling cableways. A combination railroad and derrick trestle was erected at the downstream toe of the dam. Three wooden stiff-leg derricks, with 60-ft. booms were mounted as travelers on this trestle. These very satisfactorily covered the main body of the dam. One similar derrick mounted on an extra high traveler proved efficient in reaching the top section of the dam and the bridge piers. Stationary stiff-leg derricks of the same size were erected upstream of each power house unit for work on these units.

Two 10-ton capacity traveling Lidgerwood cableways of 1,530-ft. span were provided for handling concrete forms and feeding those portions of the job not covered by the derricks. The cableways handled practically all of the work on the bridge piers and decks as well as a large portion of the upper part of the power house. The cableways were used on handling rock excavation and concrete in the body of the dam whenever they were not absolutely required on special

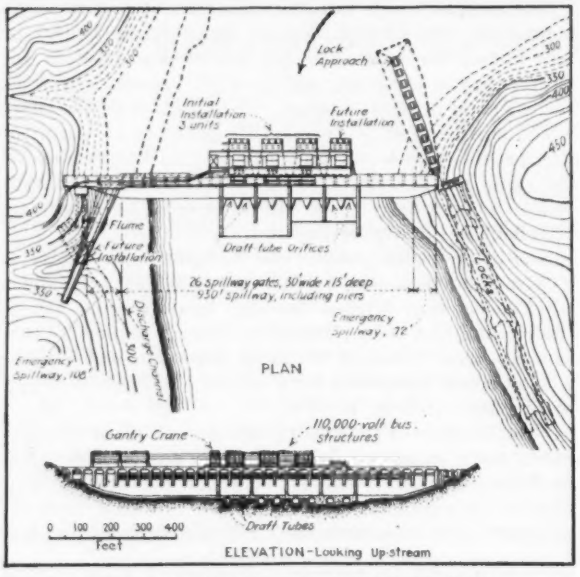


FIG. 4—PLAN AND ELEVATION OF DAM
Showing location of future canal locks.

work. When on straight concrete work a cableway carried an average of twelve 2-cu.yd. batches per hour, whereas the derricks had a considerably greater capacity. One derrick placed 220 2-cu.yd. batches of concrete in eleven hours, in addition to 32 cu.yd. of derrick plum stone. This gives the derrick an average of 43 cu.yd. per hour, as compared with 24 cu.yd. per hour for a cableway.

Yard and Plant Railroad—All tracks on the low level (river bottom) were narrow gage, 36-in.; the ½-mi. track from quarry to crushing plant and main warehouse was of both narrow and standard gage. The decision to use 36-in. gage tracks on the job was based on the use of electric locomotives with a third rail system, cheaper construction costs and lighter units for handling concrete, which greatly reduced the cost of the trestle on the lower face of the dam.

The principal motive power on the 36-in.-gage line was six 8-ton Baldwin-Westinghouse type locomotives, equipped with a steel shoe for sliding connection with a third rail placed 21 in. outside of the running rails. In addition to the contact shoe, each locomotive was equipped with a reel on which was wound about 200 ft. of conductor cable so that the locomotive could operate some distance beyond the end of the power rail. Workmen were protected from the third rail by a guard side board and cover boards.

In general, the electric traction was highly satisfactory on permanently installed tracks, but was a nuisance on tracks subject to frequent moving or where for various reasons the third rail could not be installed on either side of the track, thus making the locomotive dependent on the cable for power connection.

Cofferdam and Steam Control—The unwatering of the dam and power house foundations was handled in three sections. Cofferdam 1 enclosed the foundations for the west half of the dam, including units 1 and 2 of the power plant. This cofferdam, at the outer upstream corner, extended to the edge of a deep channel of the river, which crossed the dam foundation at an angle of 64 deg. with the axis of the dam. This section of the cofferdam enclosed an area of approximately 5 acres, having a length of 600 ft. and a width, up and downstream, of 400 ft. The average height of the cofferdam was 18 ft. The upstream and downstream arms of the cofferdam consisted of timber cribs rock-filled, sheeted on the outer side, and provided with toe fill of earth and clay. The outer arm, exposed to the swift current of the river, consisted of a double line of rock-filled timber cribs with a clay chamber between the two lines of cribs.

Cofferdam 2 was constructed during the flood season in the spring of 1922, to enclose the east end of the dam foundations; it extended from the east bank 136 ft. to the east edge of the deep channel above mentioned. A clear opening 200 ft. wide, including the deep channel of the river, was left between Cofferdams 1 and 2. This channel was computed to have a capacity of 65,000 sec.-ft. before flooding Cofferdam 2.

The closure cofferdam or Cofferdam 3, crossing the deepest channel of the river and enclosing the foundations for units 3 and 4 of the power plant, was started as soon as the spring floods of 1922 had passed. As the construction of the third cofferdam proceeded, the first two cofferdams were removed and the river was gradually diverted through eight culvert openings left in the west end of the dam and over a 102-ft. spillway gap left in the east end of the dam. These water passages had a capacity of 35,000 sec.-ft. before the third cofferdam was overtopped.

A section of the upstream arm of this closure cofferdam had a maximum height of 42 ft. and as it was all constructed in swift water it presented quite a construction problem. The 36-ft. square cribs of 12 x 12-in. timbers were started on top of the completed cofferdam, then lowered to water surface by crane, and held in position by cables. They were sunk by building up the timber cribs, and were filled with rock after landing on the river bottom. On account of the great depth and swift water, steel sheet piling was used for sheeting this cofferdam instead of the planking and earth used on the other cofferdams.

The pumping equipment used for the cofferdam work consisted of belt-driven and direct-connected motor-driven centrifugal pumps.

As the eight culverts through the westerly end of the dam were lower than the spillway gap left in the east end of the dam, these culverts carried the full flow of the river during low stages of the river. The spillway gap was therefore filled first without any difficulty. The culvert entrances, divided by a central pier into two parts, were provided with a heavy timber gate for each opening, hinged at the top of the opening and held open by cables. The closure of the culverts was made when only four to five feet of water flowed through them by cutting or loosening the clamps on the cables and permitting the gates to drop into place. The culverts were concreted, after the leakage through the gates was reduced to a point where it could be carried in a few small pipes. These drain pipes were grouted later.

Quarry Operations—The coarse aggregate for the concrete was secured by local quarrying and crushing operations. The quarry was located on the right bank of the river one-half mile below the dam. The rock was a hornblende schist found in an almost vertical cliff 130 to 150 ft. high. The quarry was too short (only 280 ft.) for satisfactory operation, but could not be lengthened on account of property ownership at one end

and very heavy stripping at the other. The quarry rock was generally hard and tough, making excellent aggregate, but due to the presence of a few soft seams and some weathered rock at the surface it required washing much of the time.

Primary drilling was accomplished with two No. 4 Loomis Clipper and two No. 3½ Keystone well drills. These drills were operated by 11-hp. and 12-hp. electric motors respectively. Records on over 3,000 ft. of drilling show an average of 9.33 ft. per drill per shift of 10 hours; drilling bits were 5⅝ in. in diam. The following record of blasting may be of interest:

Pounds of explosive used	69,000
18 per cent was 75 per cent gelatin dynamite for the bottoms of holes.	
61 per cent was 60 per cent and 21 per cent was 40 per cent ammonia dynamite for the balance.	
Cu.yd. of rock, solid measure, per foot of hole shot	11.9
Cu.yd of rock, solid measure, per lb. of dynamite	1.74
Pounds of powder per cu.yd. of rock	0.575

Blasted rock for the crushers was loaded by steam shovel, equipped with a 2½-cu.yd. dipper, in 5-cu.yd. dump cars, 36-in.-gage, operated in trains of 4 to 5 cars by 8-ton electric locomotives. Derrick plum rock was loaded by a 15-ton locomotive crane; this crane also helped on moving the quarry tracks.

Crushing Plant—The primary breaker was a 48 x 60-in. jaw crusher, set for a 7-in. opening, driven by a 150-hp. motor. This type of crusher was selected on account of the larger size of rock that could be fed the crusher as compared with a gyratory crusher of equal capacity or cost. The rock was conveyed from the jaw crusher by a 42-in. belt conveyor to a 72-in. x 16-ft. screen over the secondary crushers. The object of this screen was to separate the fines for the sand rolls, 3-in. to 6-in. size and oversize for the secondary crushers, and 6-in. to 8½-in. size to use as mixer plum rock. The secondary crushers were two 12-in. gyratories, one of the gyratories later being exchanged for a 16-in. crusher.

Mixing Plant and Concrete Materials—Two 2-cu.yd. mixers mixed all the concrete for the job. Erected over the mixer measuring hoppers were bins for cement, sand and two sizes of crushed rock; these bins had sufficient capacity to furnish materials for 350 cu.yd. of concrete. All materials were delivered to the mixer bins by belt conveyors.

Cement storage was provided for 3,100 bbl. in bins and 16,800 bbl. in warehouses. An attempt was made to get the major portion of the cement shipped loose and get sacked cement only for the reserve storage in warehouses. All bulk cement shipments were received in good condition. Although a scraper unloader for the bulk cement was provided, the labor crew unloading cement preferred to use shovels to pass the cement to the car door chute leading to the storage bins. Unloading the bulk cement was no more costly, nor more difficult to keep a full crew employed, than with the sacked cement. While there was an initial saving of 5 cents a barrel in the first cost of the bulk cement, the greater saving was in handling and loss of sacks. Only 41,000 bbl. of bulk cement were received, as the cement company had difficulty in loading the bulk cement at the same time it was loading sacked cement.

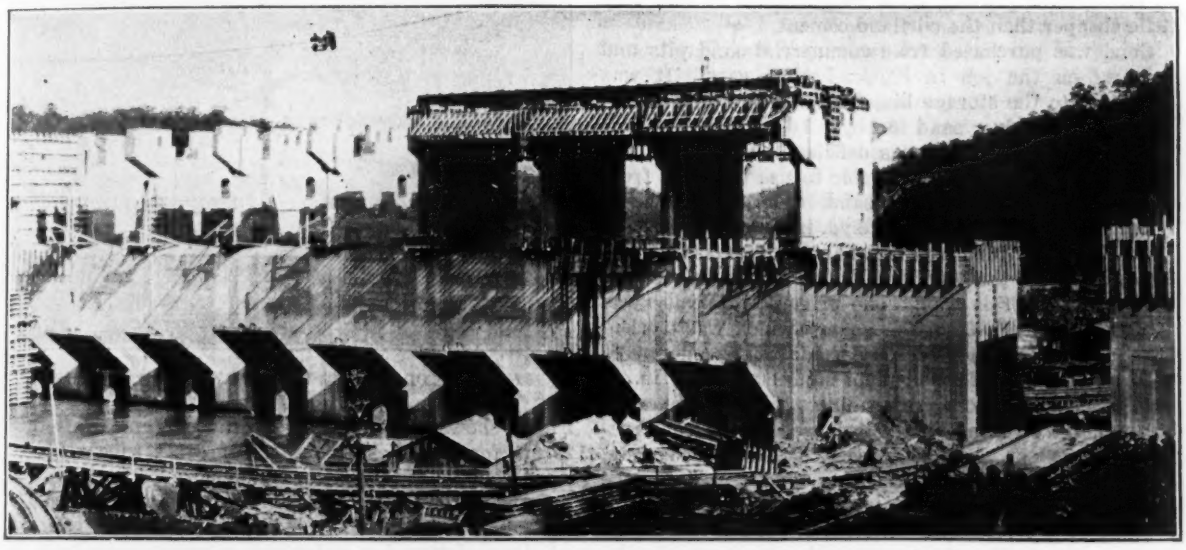


FIG. 5—CLOSURE GATES FOR STREAM CONTROL AND BRIDGE PIERS
Showing method of supporting forms for bridge deck.

Passing the cement from the bulk bin to the 16-in belt conveyor caused some difficulty due to the tendency of the cement to flow in waves. After considerable experimentation, it was found that a 6-in. pipe inserted in the bin bottom and discharging close to the belt gave best results. The pipe was closed by a radial gate over the lower end of the pipe. Where loose cement is used in large quantities, it is believed that a weighing machine should be used instead of a measuring hopper, as was done here. On account of the dust, it is difficult to control manually the filling of a box to the same elevation for each batch.

Slag cement was used in the amount of 29,200 bbl. This was used only in the mass concrete to the extent of 0.208 bbl. per cubic yard of the mass concrete. The slag cement was very slow in setting so was not used at all in the reinforced concrete. Long-time tests of mixtures of the slag and standard portland cement showed strengths equal to or greater than those of the straight portland cement tested at same time. The slag cement

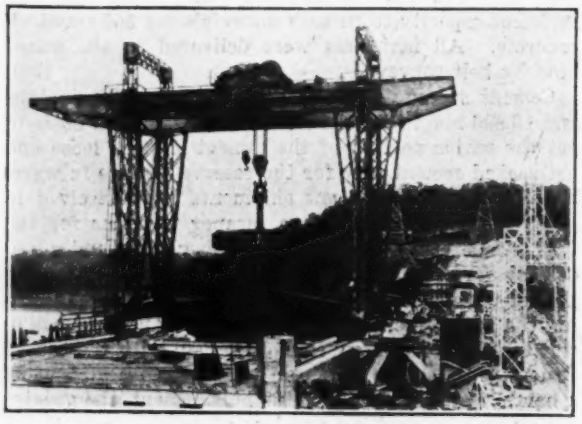


FIG. 6—GANTRY CRANE AND 125-TON ROTOR

was very finely ground, so it made an easy flowing, workable concrete. On a volume or barrel basis, it was considerably cheaper than portland cement, but, due to low specific gravity, on a weight basis it was very little cheaper than the portland cement.

Sand was purchased from commercial sand pits and received on the job in hopper-bottom cars. It was dumped into the storage bin, from which it was transported to the mixer sand bin by a 16-in. belt conveyor. This washed bank sand was deficient in the fine sizes, so it was not found objectionable to use the fines from the quarry and crushers as sand.

Derrick plum rock, up to 4 cu.yd. in size, were selected from the draft tube excavations and from the quarry for dropping in the concrete. Only 8,971 cu.yd. of rock were placed in this way. The principal difficulty was to secure the rock from the quarry which was worked primarily for crusher rock. An additional amount of over 8,000 cu.yd. of small plum stones up to 8½ in. in size, was passed through the mixers with the concrete. The amount of reinforcing steel used in the construction of the plant was 1,205 tons. Of the total concrete, 39 per cent was classed as cut-up and required more or less reinforcing steel.

Concrete Forms—The construction of the concrete forms, next to the stream control, was probably the most complicated and difficult problem to be solved.

For the straight sections of the dam, panel forms were used. These panels, designed to be moved by derricks or cableways, were 5 ft. high by 17 ft. 10 in. long. The vertical posts were 6 in. x 8 in. x 8 ft. 6 in., spaced 36 in. apart and lagged with sized 2-in. lumber for 5 ft. height. The post projecting above the form for a distance of 3 ft. 4½ in. supported the next tier of forms. Two ¾-in. anchor bolts were used in each post for each 5-ft. lift.

The expansion joints in the dam were spaced 72 ft. apart, except opposite the power house units where the joints were 108 ft. apart. These lengths between expansion joints correspond to two and three spans of the bridge, respectively, for the bridge piers on top of the dam are 36 ft. center to center and all expansion joints come at one side of a bridge pier.

The bridge pier forms were built in large panels 36 ft. long and with three lifts of form for the 34-ft. height of the pier. As the piers were only 6 ft. thick, through bolts were used to hold these forms.

An unusual design of form support was used for the 32 spans of the bridge deck. Four spans of this deck at the west end of dam were 56 ft. wide in order to make room for the two circuit feeder sections of the substation structure. The next ten spans were 44 ft. wide and supported the bus tie and lightning arrester sections of the substation as well as the railroad track to the plant. The balance of the bridge deck was 32 ft. wide. The bridge deck is of flat-slab girder type reinforced concrete. Most of this deck was constructed after the pond had been filled and water was passing over the crest of the dam. The forms were supported from 30-in. and 36-in. heavy plate girders resting on blocking on top of the bridge piers. Four steel girders were required for the narrower sections of the deck and seven for the wide sections. Timbers 8 in. x 8 in. were suspended by 1¼-in. rods and U-bolts under these girders and the bridge floor forms were built up on these suspended timbers.

The forms for the power house units were very complicated as the turbines had concrete casings and the first two draft tubes included hydraucone regainers.

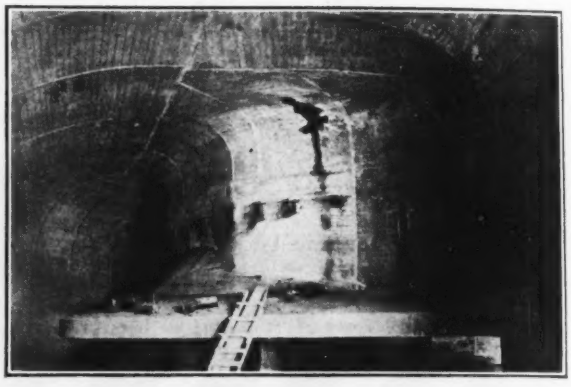


FIG. 7—HYDRAUCONE REGAINER IN DRAFT TUBE

Fig. 2 shows a view of the hydraucone and draft tube forms for unit 2. This form of draft tube required more complicated formwork and more rock excavation than were required for the draft tubes constructed for units 3 and 4 where the hydraucone bell was omitted. All these forms for waterway openings were built in the shop in segments and were fitted together in place in lifts much like a set of blocks.

The heavily reinforced beams over the waterway openings required continuous concrete pours of considerable height. The height from the top of the draft tube floor to the generator foundation was 105 ft. This height was divided into four construction stages. The continuous pour from draft tube floor to bottom of turbine casing was 33 ft. high and required 4,200 cu.yd. of concrete. The next stage had a height of 41.5 ft. in which 3,850 cu.yd. of concrete were placed in one continuous pour of 4½ days' duration.

Permanent Plant Erection—Very little could be done on the plant erection until the bridge over the dam had been completed from the west bank out to the power house section. Then the permanent gantry crane was the first equipment needed but its erection rendered one of the cableways practically useless on account of the interference.

This double gantry cantilever crane is designed to handle the heavy parts of the turbines and generators. It covers a side track of the railroad on deck of dam, an erecting space between the machine shop and unit 1

FIG. 8—LOCATION OF CONSTRUCTION TRACKS AND CONCRETE MIXING PLANT

of the power plant and the four power plant units. The main hook has a capacity of 125 tons between crane legs and a capacity of 70 tons, on both cantilevers, at a distance 13 ft. outside of legs. The auxiliary hoist has a capacity of 20 tons. The upstream cantilever of the gantry covers the trash racks, stop logs and penstock gates while the downstream cantilever covers the 7,500-kva. transformers located outdoors on the roof of the operating room.

The erection of the gantry crane was completed on the last day of January of this year and it was immediately placed in service on the erection of the first unit of the power plant. The first unit was put in service, on the line, on April 7, followed by the second 24,000-hp. unit on May 25. The third unit was placed in service during August.

The elapsed time from the beginning of the work to the placing of the first concrete was 187 days; to the final closure of the dam and filling of pond, 545 days; and to the completion of the installation of the first power plant unit, 621 days. The entire project will be completed and in operation within 25 months from the date that the license was granted to the Alabama Power Co. by the Federal Power Commission

The turbines were built by the Allis-Chalmers Co., and the generators by the General Electric Co. The construction work was done by the Dixie Construction Co., a subsidiary of the Alabama Power Co.

O. G. Thurlow, chief engineer of the Alabama Power Co., was in charge of the work, and was also the originator of the backwater suppressor used.

Modern Engineering to Save Mediaeval Tower

Reinforced concrete is to be used to prevent the collapse of the great tower of the Strasbourg Cathedral designed by Jean Hultz in 1439. The original footings of the tower are of stone masonry on wooden piles. At the time of construction these piles were entirely sub merged. About 1750 a new drainage system so lowered the level of the ground water that the tops of the piles were no longer submerged and they have subsequently decayed and permitted the tower to settle. Moreover the tower as finally completed was considerably higher and heavier than the one planned by Hultz at the time the footings were laid. In order to reinforce this old foundation and to replace the decayed piles, the columns of the tower have been encased in concrete to provide a hold for jacks and the whole tower has been jacked back into proper place and the old footings are being replaced by larger footings of reinforced concrete.

Status of Interstate Water Compacts

TREATY making between western states over irrigation water rights has been progressing rapidly since the Colorado River Compact was negotiated at Santa Fe, N. M., last November. Of the seven states involved in the Colorado case all but Arizona have ratified the action by legislative act. Compacts have been consummated or are under advisement in six other cases as follows:

The La Plata River compact between Colorado and New Mexico was negotiated at Santa Fe immediately following the Colorado River compact. Both states have ratified the treaty by legislative enactment. Congressional ratification is the final step. No enforcement of this compact will be attempted until Congress takes action. The La Plata River is a small tributary of the San Juan rising in the La Plata Mountains just southwest of Durango, Colo. The amount of water involved is small, about 60,000 acre-feet annually, but it is a concrete example of an interstate stream requiring legislative action by two states in order that future development may be placed on a sound basis. The commissioner for New Mexico was Stephen B. Davis, Jr., an attorney of Las Vegas, N. M.; Delph E. Carpenter represented Colorado.

Early in March an interstate water treaty was made between the states of Nebraska and Colorado on the South Platte River. R. H. Willis, engineer of Bridgeport, Neb., represented Nebraska and Delph E. Carpenter, Colorado. Nebraska has already ratified, but the Colorado legislature had adjourned at the time the compact was entered into and legislative enactment may be deferred until the regular session of the 1924-25 legislature.

Negotiations have been under way for over two years concerning an interstate settlement of the water of the Arkansas River. Litigation is in active progress on the Arkansas River concerning its interstate problem at this time. It has been pursued off and on for a period of over twenty years. George S. Knapp, Kansas state irrigation commissioner, and Delph E. Carpenter, for Colorado, constituted a commission instituted by the legislatures of both states to negotiate a compact.

Negotiations are now under way for an adjustment of the interstate water problems of the Rio Grande between New Mexico, Colorado and the federal government. Attorney J. O. Seth, of Santa Fe, is the New Mexico commissioner, and Delph E. Carpenter the Colorado commissioner. No commissioner has, as yet, been appointed for the United States. R. I. Meeker is associated as engineer for Colorado, with the attorney, on both the Arkansas and Rio Grande interstate water problems. He also served as engineer for Colorado on the Colorado and La Plata Rivers compacts.

An interstate water problem is imminent on the North Platte River among Nebraska, Wyoming, Colorado and the federal government. Wyoming, by legislative enactment in June, 1923, provided for negotiations, but so far a commissioner has not been appointed. Neither of the other states has passed legislation concerning this stream.

The states of New Mexico and Texas have provided by legislative enactment for a compact on the Pecos River between New Mexico and Texas. The federal government is also a party to the negotiations on account of the reclamation project in that stream basin.

Highway Development by the Alaska Road Commission

Wagon, Sled and Tram Roads—Trails, Ferries, Cableways—Truss and Suspension Bridges—Light Roads and Good Trails Needed—No Hard Surfacing—Day Labor—Organization and Transportation

By James Gordon Steese
Major, U. S. A. (retired); President, Alaska Road Commission, Juneau, Alaska

SINCE ITS organization in 1905, the Alaska Road Commission has expended about $8,000,000 for the construction, repair and maintenance of roads, tramways, ferries, bridges and trails. The work thus far accomplished includes the construction of 1,114 miles of wagon road, 623 miles of sled road, 4,404 miles of permanent trail and 712 miles of temporary flagged trail, a total of 6,854 miles. For the current working season, about $900,000 is available, including both federal and territorial funds.

The improvements contemplated for 1923 include a great variety of forms of pioneer construction, ranging from a cableway and cage over a glacial torrent, or a line of stakes set across the treeless tundra or a frozen arm of the sea, to a well located, graded and graveled road, or a steel bridge of five 150-ft. spans on piers consisting of twin cylinders of interlocking steel sheetpiles filled with concrete. A typical road and winter trail are shown in Fig. 1, the tripod on the latter being a marker to indicate the route. A road map is shown in Fig. 2.

FIG. 1—TYPICAL ALASKA HIGHWAYS

Above: view on Ophir-Tokotna Road. Below: winter trail; the tripod is a marker set up by the road commission to indicate the route.

Types of Construction—Under the classification of the commission, "wagon roads" are any roads cleared, grubbed, ditched, graded and drained sufficiently to accommodate wagon traffic. Light motor vehicles (up to 2-ton trucks) are now using these roads in increasing numbers and about 800 miles have been given a gravel surface 14 ft. wide at an increased first cost, but with an eventual saving in annual maintenance charges. "Sled roads" are cleared and graded like wagon roads, but not grubbed. They are drained only sufficiently to prevent their destruction by the summer rains. Their wearing surface is of snow. Double bob-sleds, drawn by two, four or more horses, haul heavy loads over these roads as well as over the wagon roads in winter time. Caterpillar tractors were successfully used during the past three winters and such traffic is expected to increase. Tractor freighting service is shown in Fig. 3.

"Trails" include any construction less than the above, suitable for dog sled or single-horse double-ender in winter or pack train in summer. Except when river surfaces are used (a practice which is very dangerous on account of numerous hot springs and overflows even in the dead of winter), some work is always necessary on account of the thick brush covering even the treeless regions, to permit the use of dog teams. "Flagged trails" represent cutoffs across frozen lakes, swamps and arms of the sea. The flags or tripods (see Fig. 1) are necessary on account of the absence of landmarks or to prevent travelers from getting lost in bad weather. Most of them must be replaced annually.

The commission maintains and operates about a dozen ferries, an 87-mile tram road with cars drawn by dogs, and several shorter trams. It has designed and erected twenty standard overhead cable trolleys varying in span up to 650 ft. Standard designs have been developed for all types of bridges. Structures built include many light cable suspension bridges designed for pack train and snow loads only, a steel highway span of 300 ft. for 20-ton trucks and combination spans up to 150 ft.

Hard-surfaced roads are not built, since neither the funds available nor the prospective traffic warrant such expensive construction. In the vicinity of the principal towns and mining districts, where the heaviest traffic exists, a heavier and wider surfacing is provided, about equivalent to a good macadam road in the eastern States. The great demand is for more and more mileage of light construction and the improvement of trails to road standard. The commission's program calls for an expenditure of $10,000,000 as rapidly as the funds can be secured.

All important bridges are designed in and purchased by the head office. Wood and steel combination bridges are most common. Fir timber from the States is secured wherever practicable. Native timber is very inferior and unsuitable for bridge work, but must be used in many localities on account of excessive transportation charges. Hundreds of culverts of native wood are built every year, but more corrugated iron culverts are being imported and eventually few native timber boxes will be permitted. Standard plans are furnished superintendents and foremen in outlying districts and they then rustle their materials as best they can. Typical bridges are shown in Fig. 4, while Fig. 5 shows the driving of steel sheetpiling to form cylinder piers which are filled with concrete.

Construction Methods and Outfits—Since Alaska is a mountainous country much heavy rock work is encountered. The commission owns several portable compressor outfits, each capable of operating several air tools. The Keystone Canyon relocation of the Richardson Highway involved three miles of benching on the vertical rock walls of the canyon some 300 ft. above

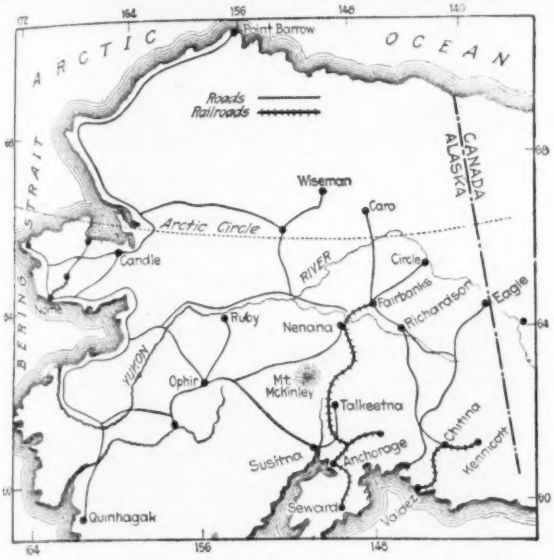


FIG. 2—PRINCIPAL ROADS AND TRAILS OF ALASKA

the bed of the river, with two highway suspension bridges of 150- and 175-ft. span across side canyons.

Clearing and grubbing is let by contract wherever practicable. Dense timber is found over a large part of the Territory. Grading is done with grading machines drawn by 5-ton crawler tractors. For the graveling, steam shovels load dump trucks or 3-yd. dump trailers drawn by 5-ton crawler tractors. In most cases, the crews are working far from a base of supplies, and must be housed and fed. The commission owns a number of horses and has warehouses, caches, garages and barns located at suitable points. Its road equipment has a value of about $500,000.

Due to the remoteness and inaccessibility of most of its projects, the commission performs most of its work by day labor. The pioneer nature of much of this work also precludes the preparation of specifications in advance at any relatively reasonable cost for surveying, engineering and supervision.

The work varies from primitive pioneer cruising and blazing of pack trails to surveying and locating well graded gravel roads and involves the constant improvement of old roads or trails. The condition of the roads continues to improve by thawing and drying out from year to year. For this reason, the carrying on of construction through protracted periods has not always been a disadvantage. The cruising, location and clearing of the right-of-way and the gradual grading results in a road structure at less total cost than would have been possible had the construction been completed the first season. In fact, the construction of a road in one season is impossible in the large areas of marshy and permanently frozen ground which always require two or three seasons of exposure to the sun's rays to become dried out and compacted. A great deal of pioneer reconnaissance work is performed each year in developing new districts.

Perhaps the worst obstacles to road construction are the numerous glacial streams which cannot be avoided and cannot be permanently controlled at any reasonable cost. Their vagaries are inconceivable. Just out of Valdez, the Richardson Highway crosses the delta of Valdez Glacier for 3½ miles, in which distance there are twenty-six trestles or short-span bridges aggregating nearly 2,000 ft. in length. During different seasons of different years water flows under any, all or none of these bridges, and nearly every year new openings are broken out between bridges. A pile driver is maintained constantly on the job.

On smaller streams, bridge abutments may be placed on permanent banks upon which heavy trees are growing, only to disappear a year or two later. Long truss spans have been left high and dry, the river moving half a mile or more to a new location, and a year or two later it may move back. In some cases wing dams, dikes and revetments have been successful for a few years, but sooner or later they all go out.

Supply and Transportation—The question of supply is the most difficult feature of engineering construction work in Alaska. Most of the interior can be reached only by river boat during the short summer season or by dog team in winter. A rate of 25c. per pound is not uncommon, and the community that can land its supplies from the nearest base for 10c. per pound is considered lucky.

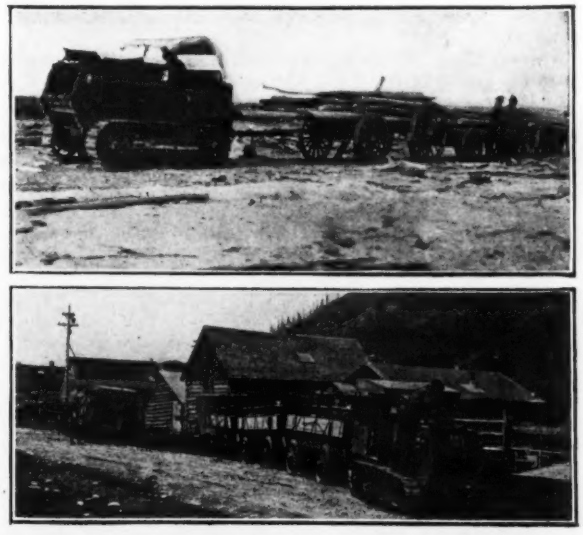


FIG. 3—TRACTOR HAULING IN ALASKA

Above: hauling poles for corduroy road in Seward Peninsula. Below: tractor-trailer freight train on Richardson Road, leaving Chitina for Fairbanks.

In the fall of 1920, the commission ordered two 90-ft. combination truss spans for a river crossing on the Richardson Highway, twenty-eight miles from Fairbanks. This material left Seattle during the following summer and was lightered ashore at St. Michael in time to catch the last boat up the Yukon River. After making nearly a thousand miles, this boat was frozen in for the winter about 200 miles short of destination. The lowest bid for freighting over the snow was $135 per thousand feet b.m., a not unreasonable charge for the service, but too expensive for our resources. The material reached Fairbanks on the first boat in June, 1922, and was freighted out by truck the twenty-eight miles at a cost of 50c. per ton-mile. Meanwhile, the old bridge was patched up at a cost of some $1,200 to last out the 1921 season.

About this time the Alaska Railroad was completed and as a result the transportation situation in the Tanana valley has been radically changed. Last spring,

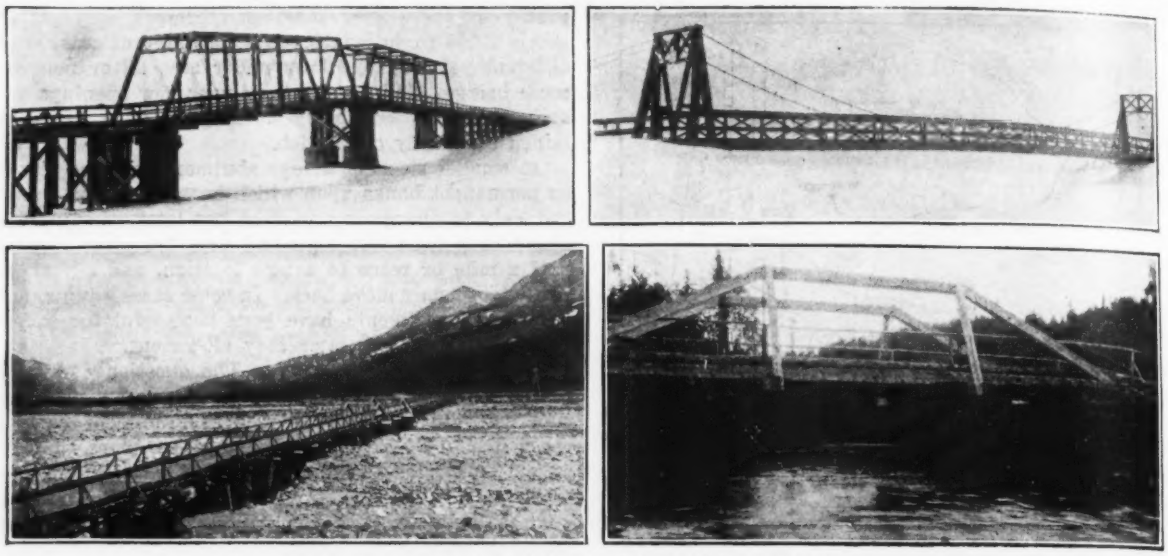


FIG. 4—TYPICAL HIGHWAY BRIDGES IN ALASKA
Above: suspension bridge over Nome River, and truss bridge over Snake River at Nome. Below: trestle near Miller's on Richardson Road, and timber truss bridge over Moose Creek.

in less than 90 days the commission took down a 100-ft. and 150-ft. combination span, using the ice as falsework, freighted them three miles with horse sleds, then shipped them 265 miles over the Alaska R.R. standard gage and 90 miles over the narrow gage, then freighted them twelve miles by tractor-drawn sleds and re-erected them over a river on the other side of the Alaskan Range with ice as falsework.

Richardson Highway—The most important project of

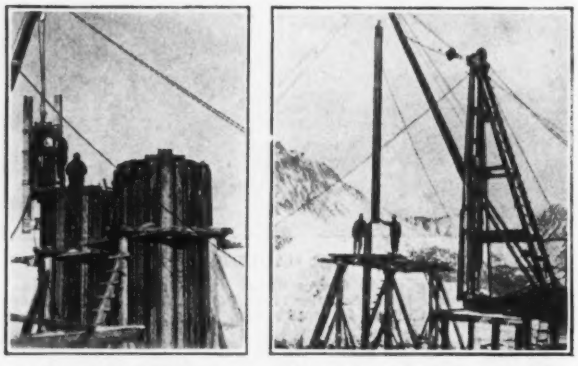


FIG. 5—BUILDING PIERS FOR NIZINA RIVER BRIDGE
Steel sheetpiling driven to form cylinders which are filled with concrete.

the commission is the Richardson Highway, extending from Valdez, an open-all-the-year south coast port, via Fairbanks to Circle, on the Upper Yukon River, a distance of 521 miles. It crosses the Chugach or Coast Range through Thompson Pass at an elevation of 2,750 ft., the main Rocky Mountains or Alaskan Range through Isabelle Pass at 3,300 ft., and the portage between the Tanana and upper Yukon River valleys. The 371-mile section between Valdez and Fairbanks has been passable for light automobiles since 1913; about fifty miles have been completed on each end of the 160-mile extension to Circle, leaving a gap in the middle of about sixty miles still under construction, but used as a bob-sled road in winter time. Along this highway are met about all the problems of road construction found anywhere in the Territory. The south coast has heavy rainfall and snowfall and is heavily wooded. The interior valleys are comparatively dry, have light snowfall and a very low temperature. The ground is permanently frozen immediately under the moss. The passes lie well above timber line and near the permanent snow line. Throughout is a jumbled mass of steep snow-clad mountains, glaciers, canyons, rivers, swamps and bare wind-swept wastes.

Organization—The Alaska Road Commission is composed, in addition to the writer, of John C. Gotwals, chief engineer, and P. A. Agnew, secretary and disbursing officer. Its headquarters are at Juneau, the capital of the Territory. District offices, each under a superintendent, are maintained at Eagle, Chitina, Valdez, Anchorage, Fairbanks, Nenana, Tokotna and Nome. A purchasing office is maintained at Seattle and a sub-office at Washington, D. C., during the Congressional hearings. The extent of the Territory may be realized from the fact that it would take a single individual, if he traveled continuously by the best means of transportation procurable, two years to inspect all the work for which the commission is responsible.

New England Railway Consolidation

Consolidation of the railways of New England into a group or regional system is recommended in the report of a committee appointed by the governors of the six New England states. The other alternative in the general project of railway consolidation was the partition of these lines to form New England extensions of outside groups or trunk lines, as noted in *Engineering News-Record* of July 26, p. 127. The proposed plan includes the Boston & Maine R.R. 2,515 miles; the New York, New Haven & Hartford, 1,950; Maine Central, 1,201; Bangor & Aroostock, 626; Rutland R.R., 415; Central New England, 295, and the New York, Ontario & Western R.R., 568 miles, making a total of 7,570 miles. It excludes the Boston & Albany (as part of the New York Central System), the Central Vermont and Portland lines of the Canadian National Railways, and all lines of the Canadian Pacific Railway.

Monorail Railroad Constructed to Tap Desert Mine

Fordson Tractor Hauls Heavy Loads on Grades of 10 Per Cent and 40-Deg. Curves, on Line to Cost Only $5,000 to $7,000 per Mile

A MAGNESIUM sulphate deposit owned by the American Magnesium Co. and located near the Death Valley Desert in southern California is to be tapped by a 28-mile monorail railroad extending over the Slate Range to the Panamint Range. Of this line about 16 miles has been completed and is carrying construction trains which are delivering material for continuing the railroad. Although detailed costs are not available, the type of construction selected, which was chosen because of the fact that it would require very little grading and would permit of sharp curves, is estimated to cost about $7,000 per mile in the rough

TYPICAL CONSTRUCTION IN THE MOUNTAIN COUNTRY
In the absence of rainfall streams are unknown and canyon bottoms make good roadbeds.

mountainous country and about $5,000 per mile in the desert with no rock work or sharp curves involved.

The construction consists of standard 6x8-in. ties, 8 ft. long, placed on 8-ft. centers. Each bent consists of a single plumb-post placed in the center of the tie and braced on either side. The plumb posts carry a 6x8-in. stringer which in turn supports the single 50-lb. rail. There are also two side rails of timber, carried by the braces, which act as guide rails, their vertical faces making contact with the rollers on either side.

The engine and cars are designed like a pack saddle, and are suspended on two wheels from the single rail. Equilibrium is maintained by the rollers on either side which contact with the timber guide rails. The motive power at present being used is Fordson tractors chain driven from both the front and back wheels which are 24 in. in diameter. On tests made with this equipment an engine so constructed carried a 5-ton load on grades up to 10 per cent. Loads of 3 tons were able to make a 14-per cent grade. This seemed to be about the maximum load that could be successfully handled on such steep grades with the Fordson power unit.

The maximum grade on the railroad as built is 10 per cent with 40-deg. curves. In operating under these

MONORAIL TRAIN HAULING CONSTRUCTION MATERIAL

conditions the only trouble so far experienced was in twisting drive shafts. This difficulty was eliminated by substituting a chain drive. Under present conditions one locomotive ordinarily hauls two cars carrying a total of 5 tons of timber distributed on all three units. The cars are 14 ft. long with wheelbase 10½ ft. long. Equipment now used has rigid wheelbase construction, but patents have been taken out on swivel cars which will greatly reduce resistance on the curves.

The foregoing was prepared from information supplied by T. H. Wright of the T. H. Wright Mercantile Co., Los Angeles, who is building the monorail line.

Elimination of Cat-Tails from Reservoirs

A COLORADO correspondent recently requested information as to the eradication of cat-tails. Lyman E. Bishop, consulting engineer, Denver, who has earned the title of cat-tail expert because of his contentions as to their existence only under swamp conditions, in an investigation in a law-suit over seepage and ground water levels, suggests lowering the ground water level below the creeping root stalks. If the ground is dry for any considerable time the plant dies.

C. R. Knowles, superintendent of water service, Illinois Central R.R. Co., makes the following comment:

> We have had some experience in removing water hyacinths and water lilies from our reservoirs in the South. We have also had some experience in removing cat-tails in our northern reservoirs. Our practice has been to pull them out by hand, destroying the roots as far as possible, but I do not know of any method whereby they can be completely removed. The use of creosote oil will help considerably and if used diligently it will in time eradicate cat-tails or other aquatic growth. The objection to creosote oil, unless used carefully, is its effect on the water. The proper method is to apply the oil at the water's edge. As the oil is heavier than the water, it will sink and come into contact with the roots of the plant, which it will kill.
>
> It is suggested that the creosote be tried experimentally at first. If possible to do so a temporary breakwater should be placed between the growth of plants and the main portion of the reservoir. This practice was followed at one of our reservoirs in Mississippi with good success in the extermination of water lilies. It is best to use the creosote when the stage of water is at the lowest as often the plant life may then be killed without affecting the water.

In a recent issue *Nature Magazine* notes many uses of cat-tails. The Germans during the war made an excellent bread from the pollen. A cotton substitute is made from the brown spikes and an artificial silk from cat-tail floss. The roots are fairly rich in starch and sugar and the Iroquois Indians formerly dried and pulverized the roots yielding a sweet-tasting flour (30 per cent starch and sugar) from which bread and puddings were made. In swampy lands from 2 to 4 tons of flour per acre may be secured. Our Colorado correspondent may find it more profitable to cultivate than to eradicate his cat-tails.

Underpinning New York Public Library Without Shores

Used Method Known as "Stealing"—Rammed Mortar Transfers Load to New Footings—Unusual Rock Conditions

By C. S. Rindsfoos
Jarrett-Chambers Co., Inc., New York City

THE UNDERPINNING of the north wall of the New York Public Library is of interest not only because the structure is a monumental one but also because of the method used and the character of the material encountered. The necessity for this work was occasioned by the extension of the Queensboro Subway from its present terminus near Park Ave. to a new terminus at Eighth Ave. This extension will have its south wall along the building line of the north face of the library, and since the bottom of the cut for the subway had to be made at a considerable depth below the footings of the building, it was necessary to underpin these footings before the cut was made.

The old spread footings of the building were of concrete and rested on hardpan. The records from the first subway constructed in 42nd St. indicated that rock was from 3 to 10 ft. below the underside of these footings. This rock, however, was found to be of a decomposed nature for a depth of as much as 13 ft., and much softer than the hardpan. It was therefore essential to carry the underpinning through this soft rock.

In view of the monumental character of the structure involved, and because the underpinning would not only have to sustain the weight of the building but also act as a retaining wall to support the earth behind it, and finally because this underpinning would be subject to unusual shock from the blasting in the rock cut alongside and below it, more than usual precautions were taken in the design and actual construction.

After a steam shovel had made the first cut down to a level of about 2 ft. above the underside of the old footings, the work of underpinning began. Holes 4 ft. wide and about 30 ft. c. to c. were sunk along the side of the building and carried down through the hardpan and soft rock to solid rock. These holes were drifted back under the old footings to a distance of 6 ft. and then concreted up to within 6 in. of the underside of the old footings. After this concrete had set sufficiently the 6-in. space was rammed full of a 1:2 mortar mixed just wet enough to be molded into balls. These balls were thrown into place by hand and rammed home with a sledge hammer and a thick wooden block. V-shaped recesses were cast in the side of these piers to make a bond with the subsequent work. In similar manner a second and a third set of concrete piers was built. When these piers were completed the intervening spaces were excavated to solid rock and closed with a curtain wall 3 ft. thick.

FIG. 1—COMPLETED UNDERPINNING FOR NORTH WALL OF NEW YORK LIBRARY

The old spread footing can be seen on the right just below the trusses supporting the sidewalk.

It should be noted that this work was carried on without the use of any shoring whatsoever. The process used is sometimes known as "stealing" and while not unusual for small buildings, has, so far as the writer knows, never before been employed so extensively or for such an important structure.

The use of rammed dry mortar in preference to the ordinary custom of using granite blocks and steel wedges was found to be most effective. Not the slightest settlement of the building occurred. Before approving of this method the engineers tested samples of mortar mixed as specified for the 6-in. layer of rammed mortar and found that it sustained a load of over 4,000 lb. per square inch.

The decomposed rock encountered on this job raises some interesting questions. It is no new thing to find a layer of soft rock overlying the solid rock on Manhattan Island, but rarely of anything like the thickness here described, which was as much as 13 ft. deep in places. One wonders whether this process of decomposition occurred before or after the overburden was laid down in past geological times, and, if after, at what rate does it go on. It might be inferred that, had the rock disintegrated before it was covered with

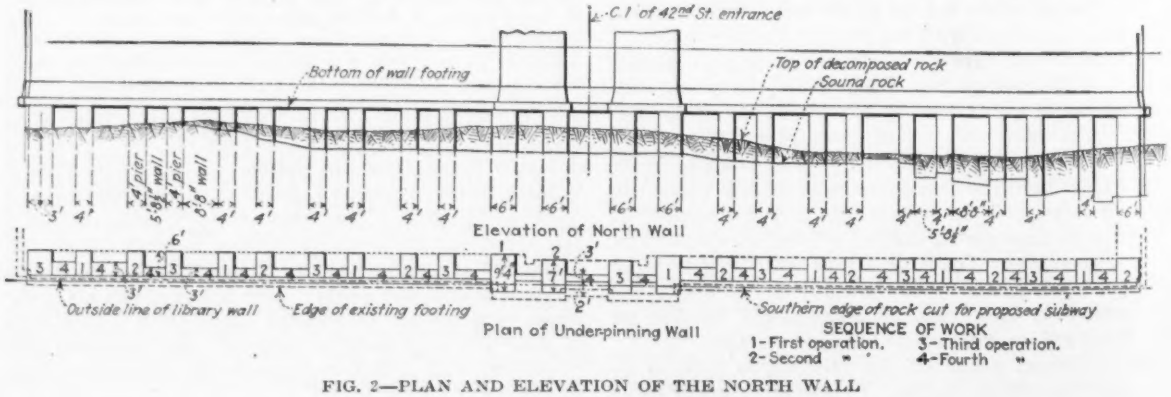

C. I. of 42nd St. entrance
Bottom of wall footing
Top of decomposed rock
Sound rock
Elevation of North Wall
Outside line of library wall
Edge of existing footing
Plan of Underpinning Wall
Southern edge of rock cut for proposed subway
SEQUENCE OF WORK
1-First operation. 3-Third operation.
2-Second " 4-Fourth "

FIG. 2—PLAN AND ELEVATION OF THE NORTH WALL

overburden, the rainwater would have washed it away as fast as it weathered. This consideration, together with the fact that, when exposed to view, it has all the appearance of sound rock, leads the writer to believe that the rock has softened in place and that this change is still going on. What, then, will be the effect on some of the heavy, deep foundations in other parts of the city? If this softening is going on now, what will be the effect of the process in the case of those buildings which have lately been founded on steel pipes loaded up to 90 tons per pipe, to say nothing of foundations constructed by more positive methods.

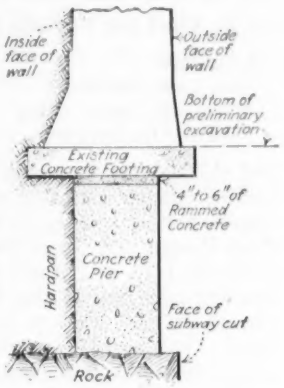


FIG. 3—DETAILS OF A TYPICAL PIER

The underpinning of the library building was performed by Jarrett-Chambers Co., Inc., New York City, under the general supervision of John H. Meyers, engineer, 2nd Division, Transit Commission, and Carrere & Hastings, Shreve, Lamb & Blake, architects for the library.

Concrete Block Ties on Railways in India

CONCRETE ties of the Stent design, of which about 200,000 are in use on over a hundred miles of main track in India, are of the block type, each tie consisting of a pair of reinforced-concrete blocks connected by a steel tie-bar. Fig. 1 shows these ties on the broad gage (5 ft. 6 in.) line of the Southern Punjab Ry., near Delhi, and their construction is shown in Fig. 2. The dimensions vary according to the gage and character of track and for maximum axle loads ranging from 14 to 26 tons. Where double-head rails are used, cast-iron chairs are attached to the blocks.

In the design shown by Fig. 2, for a gage of 5 ft. 6 in., 110-lb. rails and 26 tons axle loads, the blocks are 25x16½ in. on the base and 6½ in. thick, reinforced by upper and lower sets of horizontal bars connected by stirrups. Secured to this reinforcement is an anchor whose end projects from the block and to which the steel tie-bar of I-section is attached by a split pin. Four plugs of treated wood inserted in the block serve to hold either drive spikes or screw spikes. The upper surface has an inclination of 1 in 20 to give the rails the desired inward slope. Each block weighs 166 lb. and the tie-bar 16 lb., the total weight of tie with all fittings being about 350 lb. A concrete mix of 1:2:3½ is made with 2 parts hard silica quartzite and 3½ parts of ¼- to ¾-in. aggregate. Only sufficient water is used to make the concrete flow when the form is shaken on a vibrating table. After being left in the forms for twelve hours the ties are cured thirty days under water and then thirty days in air, but are usually at least three months old before being laid. Their life is estimated at fifty years.

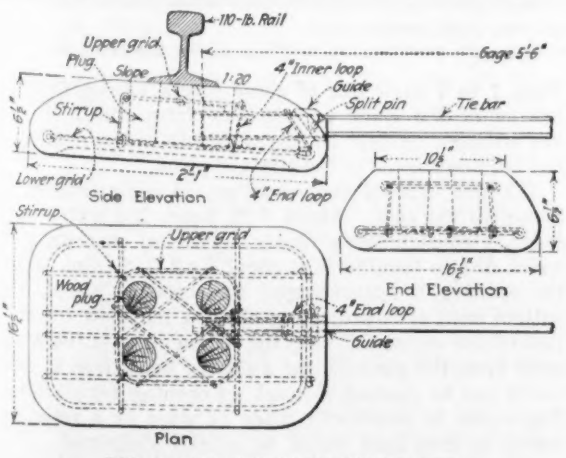


FIG. 2—THE STENT CONCRETE TIE

A few of the ties which have been in service for about nine years are said to be in as good condition as when laid, certain defects in earlier experimental ties having been eliminated. Their first cost in India is higher than that of wood ties, as steel and cement have to be imported, but when compared on the basis of life and cost the concrete ties are said to show a marked economy. These ties are in use on several railways in India, their most extensive use being on the Northwestern Ry., which has laid them on seventy-five miles of track and is laying fifty miles additional this year. Broken stone ballast is used, 6 to 8 in. deep under the blocks.

FIG. 1—CONCRETE BLOCK TIES ON SOUTHERN PUNJAB RY.

These concrete ties are the invention of D. H. Stent, consulting engineer, Delhi, India (or care of Grindlay & Co., London, England), who was formerly executive engineer of the Bombay, Baroda & Central India Ry. They are manufactured by Bird & Co., Calcutta, India.

Signs Removed from Washington Highways

Advertising signs have been gradually eliminated from Washington state highways, according to a report from the highway division of the Department of Public Works in that state, and in a final "clean-up" in the Spokane district 5,000 advertising signs were removed from 1,100 miles of state roads. Although advertisers have offered some objection, the traveling public is very much pleased, according to the report, which states that "the highways look much cleaner and in many cases are safer, as signs on curves have been eliminated as much as possible."

Utilization of Methane Gas from Imhoff Tanks

One Year's Experience at an Essen-Rellinghausen Plant Indicates Gas Production of 0.3 Cu.Ft. per Capita Daily Which May Be Used for Various Purposes

By Dr. Ing. Karl Imhoff
Chief Engineer of the Ruhrverband, Essen, Germany
Translated from the German by Harold M. Lewis *of the Physical Survey, Plan of New York and Its Environs*

SINCE the time when sludge chambers were first used in sewage disposal it has been known that the gases developed in them were useful ones. These gases come from the biological destruction of the sludge (not from the liquid sewage, as has recently been emphasized in published articles). Their usefulness consists chiefly in the high content of methane (fire damp, marsh-gas), CH_4.

Collection of the Gas—The gases have not been much utilized up to the present time because it has been considered necessary to build large roofs above the water level to collect them. This not only required heavy expense but also greatly complicated the operation of the plant. The few examples of the utilization of the gases which have been mentioned in the technical press deal with small sludge chambers which already had, for other reasons, a solid concrete roof. It is not recommended that large plants should be built of this type, where the gas roof is above the water level and there is therefore a large gas chamber, for if there is the least leak in the roof a great loss of gas will result. Still worse, there is the danger of an explosion from the entrance of air, and many accidents of this kind have already been recorded.

It is much better to place the gas-intercepting roof below the water level. In the two-story Imhoff tanks, with separate settling and sludge digestion chambers, this type of construction is very suitable, for they already have, as partitions between the two chambers, thin sloping reinforced-concrete walls which collect and lead obliquely to the vents at the water level—the gas bubbles arising from the entire surface of the sludge. (See following articles by me: "Eight Years of Imhoff Tank Design and Operation," *Engineering News*, Jan. 6 and 13, 1916, pp. 14 and 52; "Separate Sludge Digestion and Improved Mixing in Imhoff Tank, *Engineering Record*, July 22, 1916, p. 101, reprinted in London *Surveyor*, 1916, p. 187.) Imhoff tanks thereby permit a simple type of gas-collecting installation by making small changes in the vent shafts. As a result of this opportunity there has recently been constructed in the Ruhr coal district the first large municipal sewage-works with provision for collecting all of the gas produced.

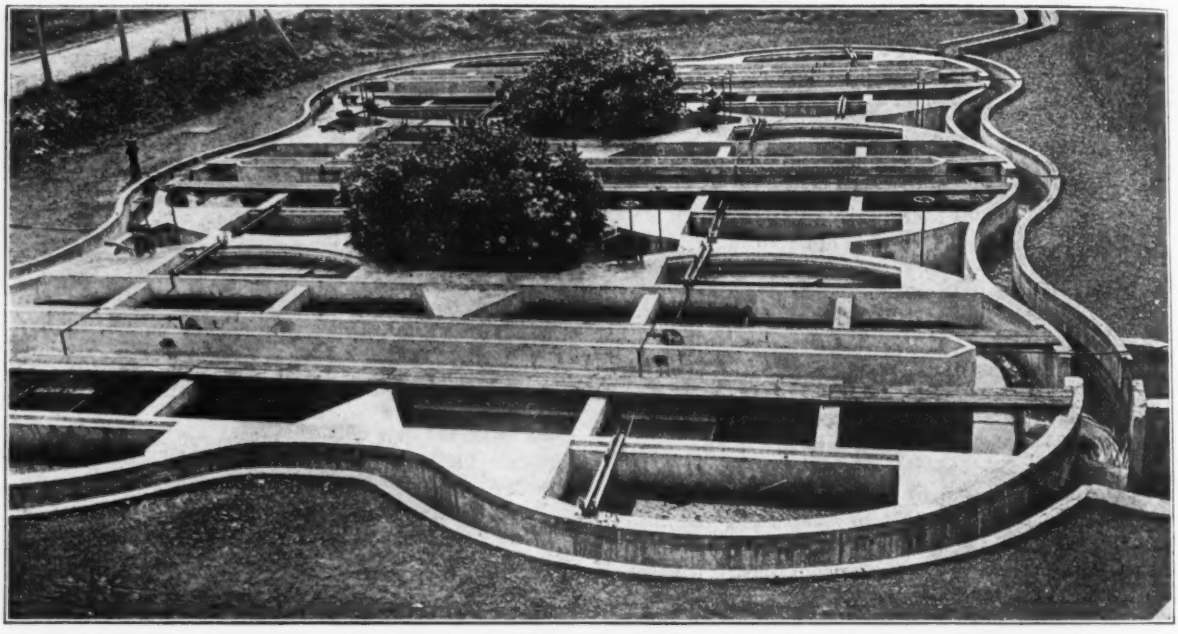


FIG. 1—IMHOFF TANKS PIPED FOR COLLECTING GAS
The first large municipal plant in the Ruhr coal district, Germany, with provision for collecting all the gas produced.

Figs. 1 to 7 show one of these plants (Essen-Rellinghausen of the Ruhr association) from which all the gas produced during the several months of its operation has been conducted to the city gas plant.

The new type of vent chamber, as reconstructed, is shown in the cuts. About 3 ft. below the water level there is constructed a nearly horizontal concrete roof which has an opening in it about 3 x 2 ft. in size. Over the opening a funnel-shaped gas hood is placed, the bottom edge of it projecting about 1 ft. below the surface of the water. To keep the coarse parts of the scum away from the gas collector a sloping fine screen is used which can be reached through an opening for cleaning. The screen is necessarily made of wood or a resisting metal, as iron bars would be quickly destroyed. The scum collecting under the screen can be removed through the opening at the side without interfering with the

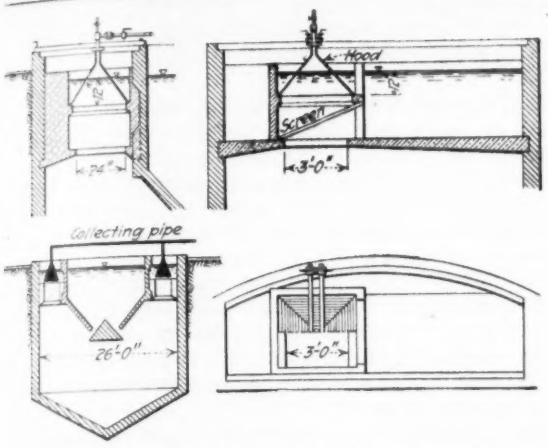


FIG. 2—DETAILS OF GAS HOODS AND PIPING
Concrete roof and water-sealed hood built in gas vent, with inclined screen to exclude scum from hood. Top of each hood connected to piping system.

collection of the gas. From the upper end of the hood small iron pipes lead the gas to the place where it is to be used. From time to time the particles of scum which have collected under the hood must be removed. For this reason the gas hood is made removable (Fig. 6). While the hood is turned back the piping is kept closed by means of a stop cock near the top of the hood. When the hood is again replaced a blowoff valve on the top of it is opened for a short time to let any air escape which may have gotten underneath it. As soon as all the air is forced out of the hood the blowoff valve is closed and the stop cock in the pipe line is opened again. In this way even a small amount of air is absolutely prevented from getting into the piping. The depth of the hood noted above, 1 ft. below the water level, is, in the present case, sufficient to overcome the gas pressure necessary to force the gas into the city gas system. In every case this depth must be computed.

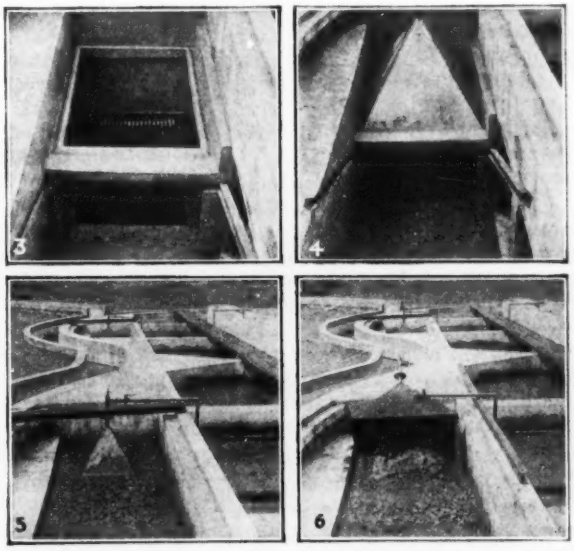
If the gas piping is shut off, or if a pipe becomes blocked for any reason whatever, the pressure under the gas hood will become greater and the gas will pass under its edge into the open. The gas hood therefore works exactly like a safety valve.

Fig. 7 shows the secondary sludge digestion tank which, in the Essen-Rellinghausen plant, as in most of the newer Imhoff tank plants, is located near the sludge drying bed. Its purpose is to restore to the sludge the gas content which has been lost by pumping, so that it will dry more readily on the drying beds. A gas roof is placed over the entire surface of this tank. In the middle of the roof is an opening for the gas and at the outer edge is a small circle of slots through which the sludge can pass as the surface of the sludge is lowered.

Amount of Gas—In a year's time a quantity of gas equal to 0.3 cu.ft. per capita per day can be assumed. A city of 100,000 inhabitants can therefore figure on 11,000,000 cu.ft. of combustible gas per year. In summer the quantity of gas is greater than in winter. It also increases if for any incidental reason the amount of sludge brought to the tank increases. If no fresh sludge is added to a tank the production of gas stops for fourteen days.

Composition of the Gas—In general the mixed gas which results consists of the following components in percentages: Methane (CH_4), 65-90; Carbon dioxide (CO_2), 5-35; Hydrogen (H), 0-10; Nitrogen (N), 0-8. In a well ripened Imhoff tank one can usually figure on the following percentage combination: Methane (CH_4), 80; Carbon dioxide (CO_2), 20; Hydrogen (H), 0; Nitrogen (N), 0 to 8.

The most important thing is the proportion between the methane and the carbon dioxide, as the latter greatly decreases the value of the gas mixture. Apparently this proportion depends principally upon the water. That is readily explained as the two gases act very differently with water; methane dissolves in it only with difficulty, but carbon dioxide is readily soluble. The carbon dioxide is taken up by the sludge chamber water almost to saturation and only the excess over this amount appears as carbon dioxide in the mixed gas escaping from the sludge chamber. If the sludge chamber water is restored with fresh water it again has the power to absorb large quantities of carbon dioxide and little of this appears in the escaping gas. This clearly explains why the content of carbon dioxide in the mixed gas in separate sludge digestion tanks is much higher (up to 35 per cent) than in Imhoff tanks, where the sludge water has the chance to equalize itself, through the sludge slots, with the water in the settling compartment. Also it is readily understood that shortly after drawing off sludge from an Imhoff tank (during which process a quantity of water corresponding to the amount of sludge drawn off is forced into the sludge chamber) little carbon dioxide is, for some time, to be found in the mixed gas.



FIGS. 3 TO 6—VIEWS SHOWING ARRANGEMENT AND OPERATION OF GAS HOODS, SCREENS AND PIPING
3. Gas opening with sloping bar screen. In foreground, side opening for scum.
4. Gas hood over gas opening; underneath, side opening for scum.
5. Gas collector in operation, with scum showing at top of vent.
6. Gas hood turned back for cleaning.

The *hydrogen* content of the mixed gas is particularly interesting. Hydrogen is most generally not found in good Imhoff tanks. On the other hand it is known that fresh fæces decompose first into an acid fermentation which develops only hydrogen and carbon dioxide, but no methane. In accordance with this, hydrogen is found in large quantities in the first stages of operation of Imhoff tanks. Likewise hydrogen can appear later when there are disturbances in the operation.

The reasons for the presence of *nitrogen* in the mixed gas have not yet been clearly explained. The nitrogen has no bearing on the utilization of the gas.

The *heat value* of the mixed gas is generally 7,000 to 9,000 calories and varies principally and inversely with the content of carbon dioxide. The high heat value is explained by the methane. In this respect the gas is superior to the city gas, for the gas of the city of Essen, for example, has only 4,200 calories, which are principally due to hydrogen.

Cleaning—As the sludge chambers are fairly warm, water separates out from the gas in the cold pipe lines. It is therefore necessary to provide the pipes with drip-pots.

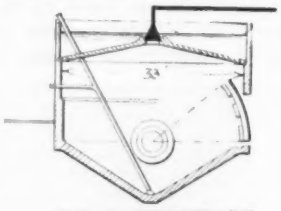


FIG. 7—SECONDARY SLUDGE DIGESTION TANK
With gas roof built under surface of sludge.

As a rule *hydrogen sulphide* is not found in the mixed gas and is undesirable as it corrodes the pipes and gas meters. As an exception, this gas may appear in those plants which have to receive very foul sewage from cesspools. It is then advisable to construct in the pipe line a filter of bog-ore such as is also found useful in municipal gas plants for the retention of hydrogen sulphide.

The content of *carbon dioxide* is, for many purposes, such as the delivery of the gas at the municipal gas plant, unharmful. If it is ever for any reason necessary to free the gas of carbon dioxide it can very easily be done by making use of its previously mentioned easy solubility in water. For example, the mixed gas might be pumped through certain sludge chambers where the sludge water has been frequently renewed. If the gas is to be delivered under pressure the necessary high pressure can be utilized for the elimination of the carbon dioxide. It is then only necessary to insert several bottles filled with wash-water between the compressor and the tanks for the receipt of the gas; the carbon dioxide must be removed from these bottles from time to time. Such a plant has been in operation in Essen for over a year.

A surprisingly simple method of freeing the mixed gas of *hydrogen* has developed from the observation already referred to above—that hydrogen arises only in the decomposition of fresh fæces, but not in a well-seasoned Imhoff tank. It must nevertheless be admitted that, with the fresh sewage, there are always received new particles of sludge which are already more or less in acid fermentation and therefore contain hydrogen. The fact that none of this hydrogen generally appears above the surface of the water forces one to the conclusion that biological forces must be at work in Imhoff tanks to convert the hydrogen into methane. To verify this by a practical experiment an artificially prepared gas mixture, to which 20 per cent of hydrogen had been added, was blown into the bottom of a well functioning Imhoff tank. The experiment succeeded fully, for *no trace of hydrogen was found* in the gas mixture coming from the tank, but only methane and carbon dioxide. It must be accepted that *the bacteria of ripe sludge convert the hydrogen*, in the presence of *carbon dioxide*, into *methane and water* in accordance with the following formula: $4\ H_2 + CO_2 = CH_4 + 2\ H_2O$. Thereby it is possible to obtain a mixed gas entirely *free from hydrogen* if the gas, just as soon as it comes from tanks which have not yet been ripened or where the operation may for some other reason be disturbed, is *blown again through ripe sludge*.

By the use of the methods outlined above for the removal of the carbon dioxide and hydrogen from the mixed gas it is possible, according to our experience, to be assured of obtaining continually a cleaned gas which contains 92 to 98 per cent methane, 0 to 8 per cent hydrogen and perhaps some carbon dioxide.

Use of the Gas—The most natural use is for the needs of the disposal plant itself, for heating and the generation of power. For instance, in several plants of the Ruhr association the chlorine disinfection houses are heated with sludge gas. If the municipal gas works, or at least a city street main, is near and accessible it is planned to deliver the gas to the gas works. Where neither of these methods of utilization is possible it is practicable to compress the gas in drums under about 150 atmospheres pressure and to sell it in this way for burning. This gas is, for example, very useful for welding and cutting, particularly as it is free from hydrogen.

For certain purposes it is desired that the gas shall not only be free of hydrogen but also of carbon dioxide. This is especially important in its applications in the chemical industry, where methane has recently been very much wanted for many purposes.

Cost—The construction cost for the entire gas collecting apparatus, including the piping on the disposal plant grounds, amounts to only 1 per cent of the cost of constructing the Imhoff tank plant. In those cases in the Ruhr coal district where the gas is delivered to the municipal gas plant the price paid by the city amounts to two-thirds of the cost of the regular municipal gas. In spite of this low price the receipts cover half of the total operation costs of the Imhoff tanks. As the price paid by the city is still much too low in comparison with the calorie content, it is assumed that the price can later be raised so that the entire operation cost will be covered. Based upon the dealings which have up to this time been carried on with chemical works, it is expected that, with the delivery of the gas for special scientific purposes, a still higher return can be received.

In any case present experience justifies a recommendation that all Imhoff tank plants be equipped with gas collecting apparatus. This is warranted not only when there is need for the gas at the plant itself but also if the gas can be delivered to the municipal mains or if it is possible to make an agreement with a chemical works. On the other hand every municipal gas plant should consider the question whether it is possible to obtain from the municipal sewage-works gas to augment and improve that in their mains. Also many chemical plants will find it advantageous to seek a connection with a large sewage-works which can furnish them with a continual and inexhaustible supply of the valuable methane.

Railway Electrification in Central Africa

The conditions under which the Leopoldville-Metadi R.R. will be electrified have been announced by a statement from the Belgian Minister of Colonies, which has been received by the Department of Commerce. The company has available 30,000 hp. for the first electrification work and can obtain 100,000 hp. more. The electrification will cost 150,000,000 francs. The gage of the line will be changed from 0.75 to 1.06 meters.

Problems and Progress in the Field of Water Supply

High Points in the Papers and Discussions of the Annual Convention of the New England Water Works Association

AT THE forty-second annual meeting of the New England Water Works Association at Burlington, Vt., Sept. 18 to 21, some fifteen papers and lantern slide talks were presented. In addition to these were a few topical discussions on Superintendents' Evening. Some of the high points in the technical proceedings are given below. The business proceedings and the presidential address—the latter dealing with society affairs—are outlined in the news section of this issue.

Filtration of Burlington's Water—Appropriately, the first paper to be presented dealt with the water supply of Burlington, Vt., the city in which the convention was held, and the second one with Vermont water supplies. Oliver J. Channing, pumping engineer, and in charge of the Burlington filters, outlined the benefits of filtration and chlorination at Burlington.

Notwithstanding a two-mile extension of the waterworks intake into Lake Champlain, Burlington continued to have much typhoid. In the period of 1904-08, there were 151 cases. Mechanical filters were put in operation on April 15, 1908. For the two years 1909-10 there were 29 cases of typhoid. In December, 1910, the use of hypochlorite was begun. The following year the typhoid cases were seven, of which six were classed as contracted out of town. In 1921, liquid chlorine was substituted for hypochlorite. In 1922 there was only one case of typhoid in Burlington.

In the discussion of Mr. Channing's paper, M. N. Baker, associate editor, *Engineering News-Record*, said that when he entered the University of Vermont, in 1882, the members of his class were warned by the president to drink sparingly of the city water until their systems became accustomed to it, lest intestinal disturbances be caused.

Public Water Supplies of Vermont—Most of the water supplies of Vermont are from surface sources, according to a paper by Charles P. Moat, chemist, Vermont State Board of Health, Burlington. The only filtered supplies are those of Burlington and St. Johnsbury. At the latter place slow sand filters were installed many years ago. Only a few supplies are chlorinated but more of the surface supplies might well be. High B. Coli counts in one of the Vermont supplies were apparently traced to droppings from deer in the drainage area. The Burlington filtered supply rarely shows taste or odor although the service reservoirs are uncovered. However, much of the supply goes to consumers, direct, and the stored water is frequently freshened, as the pumps deliver through the distribution system to the reservoir.

Sub-Surface Supply, Newton, Mass.—A paper sent by Edwin H. Rogers, city engineer, Newton, Mass., brought out the fact that after many years of use the driven-well supply of Newton had not deteriorated in quality nor given trouble from iron. This was attributed to the moderate draft upon the wells.

Reservoir Covering—A lengthy paper on "Covering Open Service Reservoirs, in Which Filtered or Ground Waters Are Stored" was sent by George C. Bunker and August G. Nolte, in charge and assistant engineer in charge of water purification, Panama Canal, Ancon, C. Z., and was read in abstract by R. S. Watson. The main point of the paper was not only that such reservoirs should be covered but also that covering them as a part of the original construction will reduce first cost. Where covers have not been provided they should be added. Experiences with open and covered reservoirs in the canal zone, showing the benefits of covers, were cited. Attention was called to the fact that at St. Louis, Mo., E. E. Wall, water commissioner, has in seven successive annual reports, advised covering the Baden and Bissell's Point reservoirs, with repeated failures to get the necessary money from the city authorities.

C. W. Sherman, of Boston, after referring to reports that the Boston Metropolitan Commission is planning to filter the Sudbury and Cochituate supplies, raised a question as to what would happen to the water thus filtered during storage in uncovered reservoirs. He thought that the present Chestnut Hill reservoir and Spot Pond are already polluted by sea-gull droppings.

Some Additions to New England Water-Works Plants—A paper by Allen Hazen, New York City, on "Some Additions to New England Water-Works Plants" was read by one of his associates, H. M. Pirnie. At New Britain, Conn., some impounding reservoirs have been built to utilize the entire economical surface yield of the drainage area and wells and pumps have been installed from which water is being pumped to a reservoir with capacity in excess of its tributary yield. At Springfield, Mass., which has had a more rapid and continuous growth than any other city in New England, and which supplies water to other municipalities, the capacity of the slow sand filters is being doubled. Studies are being made for the filtration of the new gravity supply, now under construction, for Providence, R. I. Tests show more color in the water than was expected. Because of this and of site conditions unfavorable to the large area required for slow sand filters, mechanical filtration is considered better for Providence. To avoid red water troubles, a large coagulation basin, well baffled, is proposed. Aeration both before and after filtration is also proposed, both to remove taste and odor and to reduce carbonic acid so as to get a "quieter water." Near the New England territory are Poughkeepsie and Albany, N. Y., both of which are using Hudson River water. These supplies are badly polluted and must ultimately be abandoned. It seems advisable to continue their use for some years longer, and to continue to make the river water safe by the present method of double filtration—scrubbers or rapid filtration prior to slow sand filtration. With prefiltration, the slow sand filters can be used for long periods without being cleaned. The Albany plant is now being overhauled, particularly the prefilters, which had been "demoralized" and become badly clogged.

Care of Large Watersheds—A general review of the forestry work, sanitary control and other matters per-

taining to the surface water supplies of the Boston Metropolitan District was given by Frederic I. Winslow, an engineer of the district located at South Framingham.

Rapid Sand Filtration at Cambridge, Mass.—The first mechanical filters for improving the sanitary quality of water, said Col. George A. Johnson in a paper on the Cambridge filters, were put in operation on April 14 of this year. The plant has a capacity of 14 m.g.d. In the main it follows standard practice. A feature that is uncommon but not new is the return of the washwater to the sedimentation basin. The water is chlorinated after filtration. The construction details of the plant were described in a supplementary paper by Mr. Stevens who was in charge of construction for Colonel Johnson. A paper describing the Smolski system of reinforcement for the concrete roof was sent by Mr. Smolski.

In the discussion of the main paper, W. C. Hawley, Wilkinsburg, Pa., said that in his filters, built in 1909-10, the washwater is also returned to the sedimentation reservoir, but not until after detention in a separate settling basin. The net washwater at Wilkinsburg is only 0.1 per cent of the amount filtered. Frank A. Marston, Boston, commended the use of the Venturi meter for washwater control, used at Cambridge, as a means of guarding against the wrecking of the filter underdrainage system. As to the Smolski roof being cheaper than the groined arch, as indicated in the papers on the Cambridge filters, Mr. Marston said that relative costs varied with local conditions, including the experience of contractors bidding on a job. In one case Metcalf & Eddy had found one of these systems and in another case the other system to be the cheaper.

Laying a 16-In. Main in Portland Harbor—H. V. Fuller, chief engineer Portland Water District, described the laying of a 16-in. cast-iron main from Portland across the harbor to South Portland. Flexible joints of the improved Boston Metropolitan District type were used for every third length. The harbor water has a temperature of 28 deg. F. in winter. Cans of fresh water buried in the marshes showed that a 6-in. clay cover would prevent freezing, but it was decided to give the submerged pipe a 3-ft. cover for protection against dragging anchors.

The pipe was laid in water ranging from shallow to 45 ft. deep. For laying, a curved cradle or chute of yellow pine timber, suspended between two floating pile drivers, was used. Before the pipe was placed in the cradle, three joints were poured on a lighter lashed to the pile driver floats—one joint gave a 24-ft. section and two joints a 36-in. section. These two sections were hoisted to the pipe-laying chute and connected by pouring the joint, thus providing a 30-ft. section. After a connection had been made between the shore and the lower end of the pipe in chute, the whole rig was moved forward. Progress was by 24-ft. hitches. The cost of the job (not including pipe) was $7.75 per lin.ft. as follows: trenching, $2; pipe-laying, $5; covering, $0.75. The contractor did not make a profit commensurate with his risk. Leonard Metcalf, Boston, was consulting engineer for the work.

Selection of Pumping Equipment for Station Economy—The economics of pump selection was reviewed in considerable detail by Frank A. Mazzur, Boston, taking one type after another. The author's data pointed to the Diesel engine as affording a high duty and being well suited to medium and small plants. In the discussion, the Diesel engine seemed to meet with general favor. Several speakers agreed that the electric-driven pump has more need of attendance than is often represented.

Worcester's Reservoirs—The nine reservoirs of the Worcester water-works were described by George W. Batchelder, water commissioner, and possible ways and means to meet the need for additional reservoirs were outlined.

Applications of the Venturi Meter—A recently discovered portrait of Venturi, high spots in hydraulics antedating and accompanying the development of the Venturi meter and an outline of progress with Venturi meter registers were presented in a paper by Frederic N. Connet, chief engineer, Builder's Iron Foundry, Providence. Among the registers described was one for use where reverse flows occur, as where water passes through a distribution system to a reservoir, then from the reservoir back into the system.

Superintendents' Session—An evening was set apart for papers and topical discussions designed to appeal to the superintendent. Two papers were read, and eight subjects listed for topical discussion. Four were taken up and the other four postponed to one of the winter meetings.

Hydrant Connections: F. A. Marston, Boston, read a paper on "Hydrant Connections for Fire Engines." There is a tendency, he said, to omit steamer connections. Against this Mr. Marston presented his own ideas and also the results of correspondence with fire underwriters, insurance, and water-works engineers, practically all in favor of at least one 4½-in. steamer connection. This may be combined with two 2½-in. outlets, or in large cities there may be two 4½- and one 2½-in. connections. The paper and discussion indicated a growing use of "pumpers" in place of the old-time fire engines, and also a tendency to lower pumping station pressures, to be made good by the use of "pumpers." The discussion also indicated a strong general opinion that fire department men do not know how to use fire hydrants and that water departments should always have men at fires to make sure there is no improper manipulation of the hydrants.

Water Hammer from a High Pressure Regulating Valve: Sydney Lee Ruggles, city engineer, Barre, Vt., recounted unfortunate experiences with a regulating valve having a very heavy unbalanced pressure. There was such severe water hammer that, year after year, weeks were required altogether to repair leaks in the pipe line. After Mr. Ruggles took charge of the works he put in a relief valve and adjusted the lever arm and float and later put on a 400-lb. weight. The final result was the almost complete elimination of the water hammer and resultant leaks.

Universal Pipe on Curves: Cement-lined wrought-iron pipe at Barre, Vt., laid as long ago as thirty-five years, is being replaced gradually with universal pipe. The flanged, machined and bolted joints on this pipe have been found readily adaptable to curves and the work has been tight.

Standard Water Meter Register: A topical discussion opened by W. C. Hawley showed that in a few

places water-works have followed gas company practice in leaving post cards, with meter dial diagrams on them, for householders to fill in and mail when meter readers find the house temporarily closed. The variety of meter dials encountered has led to an appreciation of the need for standardization of meter dials. The convention authorized the Executive Committee to revive the meter specifications committee of the Association in order that it may take up dial standardization with the similar committee of the American Water Works Association.

Brass Pipe for Services: The discussion on this topic indicated that a few works are using brass in place of steel or lead services, but the discussion ran off into the relative life of wrought-iron and steel pipe, electrolysis and other side questions.

Protection of Water Mains Crossing Bridges: A few examples were given but the consensus of opinion seemed to be that except where the circulation of water is very slight no protection from freezing is needed. The difficulty of getting an airtight protection was emphasized.

Valve Boxes at Main or Curb: No one seemed to know of any New England city except Worcester where valve boxes are set at the main (in the street) instead of at the curb and there was but little sympathy expressed for such a departure from common practice. The argument for location at the main is that by that means only can the entire length of the house service be controlled.

Supply Men Papers—Friday morning was given up to four papers which were essentially supply men or manufacturer's papers, although one dealt chiefly with steam gaging practice.

Manufacture of Wrought-Iron Pipe: A. A. Getheman, of A. M. Byers Co., showed by films the whole process of making wrought-iron pipe, from loading ore at the mines through to galvanizing and testing the pipe.

Testing, Maintenance and Operation of Large Gate-Valves: Allegations of no material improvements in the design and manufacture of large gate-valves since 1880, of careless maintenance once the valves are buried, and of serious mishaps when attempts are made to operate these buried valves were made by Payne Dean, New York City, who also described his motor-truck-mounted and motor-operated valve, opening and drainage pump equipment and his electric control system by means of which one or more valves may be closed or opened from a distant point.

Records of Steam Flow: With the substitution of local examples (New England) C. C. Covert, of W. L. & L. E. Garley, Troy, N. Y., gave much the same paper as he presented at the A. W. W. A. meeting at Detroit, last June. In general, the steam gaging methods of the U. S. Geological Survey were illustrated and explained.

Chlorine Control Apparatus: Something of the evolution of chlorination apparatus for water disinfection, and the latest improvements in this field were described by Gilbert H. Pratt, New England Agent of Wallace & Tiernan. Among the lantern pictures were two showing the largest chlorination plants in the world. These are at the Cleveland sewage-works, the latest one, recently put in operation, having a capacity to feed eight tons of chlorine in 24 hours.

New Engineering Organization on a British Railway

EXTENSIVE changes in the engineering departments of British railways have been made necessary by the consolidation of all the several lines into four great systems. The new administration and engineering organization of the Southern Ry., which is the smallest of these systems, with 2,200 miles, has been announced recently and a summary of this organization is given below:

Administration—The Board of Direction consists of twenty-one members, including the chairman, and has the following committees to deal with the various matters incident to the business of the company: (1) Law and medical, (2) traffic, (3) engineering and real estate, (4) locomotives and passenger and freight cars, (5) docks and marine, (6) stores, (7) finance and rates. The departmental system of organization comprises the following departments: (1) Executive, (2) secretarial, (3) legal, (4) accounting, (5) real estate, (6) rating, (7) operating, (8) commercial, (9) civil engineering, (10) locomotive and car construction and maintenance, (11) docks and marine, (12) electrical engineering, (13) purchase and supervision of horses (for cartage service), (14) stores, (15) medical, (16) police. All department heads report to the assistant general manager.

Engineering—The chief engineer, as head of the civil engineering department, has under him the following assistants: deputy chief engineer, chief assistant for parliamentary purposes, permanent way engineer, new works engineer, engineer of bridges and roofs; engineer for heating, lighting and water service; architectural assistant; quantity surveyor; signal engineer; telegraph and telephone assistant; and several district engineers.

The staff of the docks and marine manager includes an engineering assistant in charge of the maintenance of the works and the preparation of plans and estimates for improvements and new works. The electrical engineer is an independent officer, mainly in charge of the supervision and control of the power houses in connection with the electrically operated lines. This does not include power plants under the control of the chief mechanical engineer and the works and marine manager, but he must be consulted in regard to maintenance, renewal and extension of these latter plants. He is also to be consulted upon all questions affecting the purchase of electricity and electric equipment for power and traction on all schemes involving the employment of electricity other than those affecting signals, telegraphs and telephones.

Hetch Hetchy Water Used in Storage Batteries

For six years water taken from the Tuolumne River, which is the Hetch Hetchy source of supply, has been used in storage battery locomotives and automobile storage batteries on the project in preference to distilled water which the city formerly purchased for storage battery use. Before the change to the river water was made the city chemist made comparative analyses and placed his O.K. on the river water and after six years experience the batteries are still giving excellent service.

Large Open Air Swimming Pool at Camp Dodge, Iowa

Walls and Floor of Reinforced Concrete—Three Million Gallons Capacity—Bath House of Concrete and Hollow Tile

By L. N. Hintgen
City Engineer, Sioux City, Iowa

CAMP DODGE, Iowa, has recently been provided with an outdoor swimming pool which is unusual on account of its size and the completeness of its equipment. Its construction is the result of a decision on the part of the state authorities to maintain the camp as a permanent training camp for state troops. The pool is so located that it forms a nucleus around which

GENERAL VIEW OF SWIMMING POOL AND BATH HOUSE

an undeveloped part of the reservation is to be made over into a park.

It is one of the largest in the middle west, being 350 ft. long and 150 ft. wide and holding more than 3,000,000 gal. of water. When filled to the overflow the water is 2½ ft. deep at one end and 9 ft. at the other. The wading end runs to 3½ ft. deep at a distance of 85 ft., and then deepens at a more rapid rate until it reaches the diving area, where eight wide springboards form convenient jumping off places for the divers. A large float has been placed in the center of the deep water section and a diving tower located on the float. The diving tower and float may be removed to clear the water for swimming races whenever desired. The great length of the deep water makes the place ideal for 100-yd. swimming races as it provides a long straightaway before the starting line is reached.

The walls and the entire floor of the tank are of reinforced concrete. Expansion joints are provided between each 90-ft. section of the side walls and between the 50-ft. squares in the floor. The water is supplied through a 12-in. cast-iron main; the fresh supply entering at the middle of the shallow end. The outlet which is at one corner of the deep end consists of a 15-in. main which empties into an artificial pond. The overflow is immediately above the outlet, and takes the water when a continuous flow exists. The flow of water from one end of the pool to the other insures fresh, chilled water at all times. Under full pressure about six hours are required to fill the pool to its capacity, and it requires a similar length of time to empty the entire basin. The outfall water as it leaves the outlet pipe passes into an artificial channel where falls have been made by two dams of a construction resembling the natural outcropping of sandstone. There is also an artificial spring cropping out of the high embankment at the outlet. On the east side there is a natural amphitheater on each side of a road, located 100 ft. from the walls. A fence marks the border of the road, and the interior grounds are sodded and planted with shrubbery. On the high ground toward the southeast is an electric light unit, equipped with reflectors, which will illuminate the entire site. Drinking fountains and a pebble beach have been provided.

The bath house is of hollow tile construction with stucco exterior, and a red tile roof in Spanish mission style. The floors are of concrete. The building is divided into two dressing rooms and two shower rooms. There are two locker rooms, the one for enlisted men containing 1,008 baskets, and the one for officers having 182 baskets. The dressing rooms are arranged to accommodate 2,000 persons a day. A heating plant is located in the basement. As the pool can accommodate more than 600 persons at one time it was decided to equip the bath house with 100 showers.

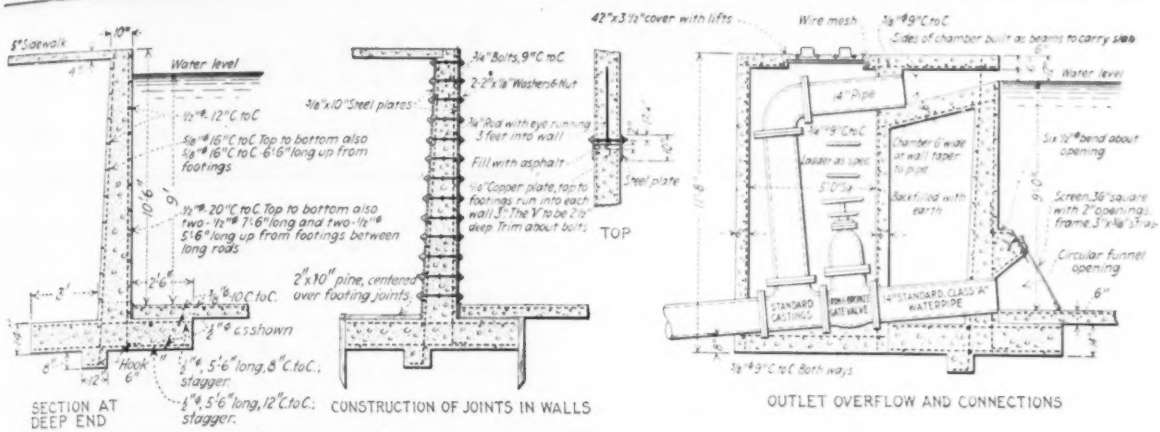
In the design of the tank walls the effects of earth and water pressures were assumed to act independently. Possible surcharge condition on the earth side was disregarded. Equivalent horizontal earth pressure was taken at 30 with assumed weight per cubic foot of 100. Water was taken at 62½ pounds. Variations from sections required by formula were based on requirements for watertightness, and on local soil and ground water conditions. Added stability to walls was given by the circular form chosen at the corners. These large sections being free from joints resisted horizontal forces easily. This was also found to form a means of equalizing and disposing of temperature difficulties. Thickness of walls had to be held at a minimum on account of available funds, but the dimensions chosen were ample to prevent seepage. A rough construction joint was formed at the junction of walls and footing by pulling out an irregular groove between vertical steel before final set.

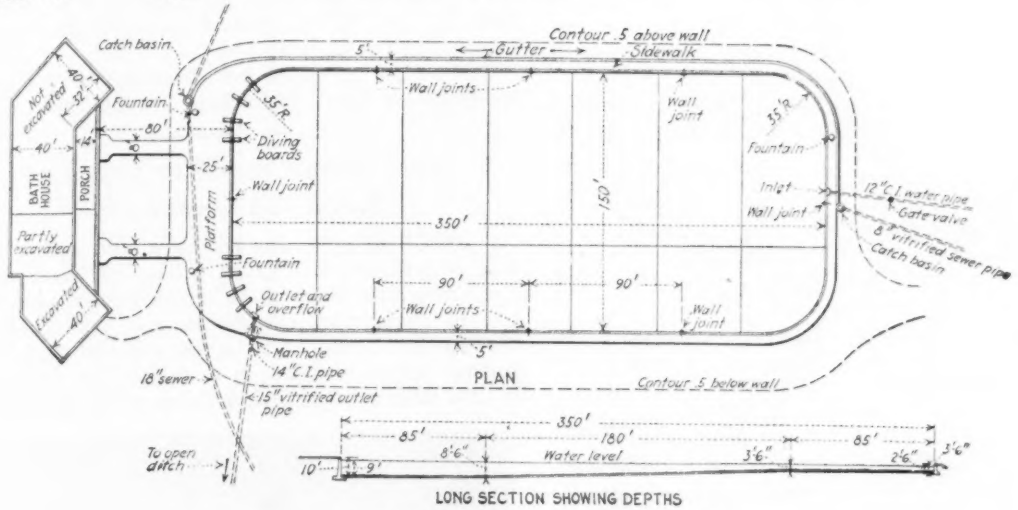
The steel content averaged about 67 lb. to the cubic yard. Closely spaced small section steel was considered preferable for the floor on account of the lightness of construction. Concrete strips 4x18 in. were poured in trenches cut in the subgrade of the floor and centered under the joints to keep the asphalt filler in place.

The original specifications called for 1:2½:4 concrete, using stone up to 1½ in., with an addition of 10 per cent of hydrated lime by volume of cement. But as the stone first delivered contained undesirable particles, this mixture was changed to 1:4 made up of bank gravel containing 55 per cent of materials over ¼ in. and an addition of about 10 per cent of stone. The lime added materially to the waterproof quality of the concrete. The outside of one of the deep walls was exposed to a 6-ft. stand of water after it was a week old and during five weeks showed no signs of dampness on the inside face. The same class of concrete was used for footings, walls, and floors.

The floor was poured by spouting. The lower four inches were spread before the reinforcing was placed. Then the upper 2 in. were poured, the excess water was expelled by roller, and finishing done by heavy wooden floats.

The expansion joints in the side walls were made 2 in. wide with a copper plate bent in the shape of a V set into the adjoining sections to close the opening. A steel plate closer was bolted to the first wall on each side to hold asphalt filling in place and to assist in keeping the walls in line. The bolts and anchor rods running back into the wall, and one edge of the copper


5" Sidewalk
10"
4"
Water level
9'-0"
6'
1/2" @ 12" C to C
5/8" @ 16" C to C. Top to bottom also 5/8" @ 16" C to C. 6'-6" long up from footings
1/2" @ 20" C to C. Top to bottom also two - 1/2" @ 7'-6" long and two - 1/2" @ 5'-6" long up from footings between long rods
3'
2'-6"
3/8" @ 10 C to C.
1/2" @ c.s.shown
8"
12"
Hook
6"
1/2" @ 5'-6" long, 8" C. to C., stagger.
1/2" @ 5'-6" long, 12" C. to C., stagger.
SECTION AT DEEP END
3/4" Bolts, 9" C. to C.
2 2" x 1/8" Washers & Nut
3/16" x 10" Steel plates
3/4" Rod with eye running 3 feet into wall
Fill with asphalt
1/4" Copper plate, top to footings, run into each wall 3". The "V" to be 2" deep. Trim about bolts
2" x 10" pine, centered over footing joints.
CONSTRUCTION OF JOINTS IN WALLS
42" x 3 1/2" cover with lifts
TOP
Steel plate
Wire mesh
3/8" @ 9" C. to C.
Sides of chamber built as beams to carry slab
Water level
14" Pipe
3/4" @ 9" C. to C.
Chamber 6" wide at wall taper to pipe
Louver as specified
5'-0" Dia.
Backfilled with earth
5 x 12" @ bend about opening
Screen, 36" square with 2" openings, frame 3" x 1/8" x 3" angle
Circular funnel opening
6"
STANDARD CASTINGS
IRON BODY GATE VALVE
6" STANDARD, CLASS "A" WATER PIPE
3/8" @ 9" C. to C. Both ways
OUTLET OVERFLOW AND CONNECTIONS



PLAN AND DETAILS OF THE TANK

were set before pouring the first wall. After pouring the second wall about the copper and allowing time for set the forms were removed and the outside plates fastened. A plate of this kind should not have holes punched until after bolts have set since it is difficult to maintain them in exact positions. Asphalt was poured as soon as plates were set.

The handrail consisted of 1¼-in. gas pipe placed three inches above the waterline. The brackets were set six feet apart. Diving boards were first designed according to American standard but this was varied later. It was found that eight boards were sufficient for a pool of this size. Ladders were made of one inch round steel.

The pool was not intended for ice skating purposes and it has been found desirable to drain it in fall and cover the floor with straw. A certain amount of tile drain was placed about the footings and below floors but it will not contribute very greatly to the safety of the bottom.

During the bathing season a small, continuous flow of water is kept up from inlet to overflow. The bacterial count has been found to be very low under such conditions. A purifying system has been inaugurated by means of daily trips of a "chlorinating boat." This method proves to be simple and inexpensive.

The cost of the pool proper and certain extras in the immediate vicinity was $33,422.03. It was built by Stark & Knotts of Des Moines, Iowa. The writer designed the pool in the offices of Pearse, Robinson & Sprague, of Des Moines, and was later sent out by the adjutant general as construction engineer. The bath house was designed and built by the Sugarman Construction Co. of Des Moines, who also had charge of landscaping and plans for the development of the camp.

To Prescribe Way of Computing Depreciation

The Interstate Commerce Commission will hold a series of public hearings starting on Oct. 1 before Examiner Fowler at Washington, upon the matter of prescribing depreciation charges for the railway properties in this country. This is being done to comply with the requirements of paragraph 5 of Section 20 of the amended Transportation Act in which the commission is directed to "prescribe for carriers subject to this act the classes of property for which depreciation charges may properly be included under operating expenses, and the percentages of depreciation which shall be charged with respect to each of such classes of property, classifying the carriers as it may deem proper for this purpose." The depreciation section of the Interstate Commerce Commission has prepared a tentative report which will be presented at this time for discussion. At the close of the hearing the Interstate Commerce Commission will give a final report upon which the depreciation accounts of the railways will thereafter be based.

From Job and Office

Hints That Cut Cost and Time For the Contractor and the Engineer

Expansion Details for Concrete Bridge Railing

By O. W. Gatchell
Office Engineer, Phoenix Utility Co., Sanford, N. C.

SUBSTANTIAL railings are the rule for present-day concrete bridges, and for a beam type, two-span skew structure as shown, with railings continued outward over wing-walls to the limits of the roadway, the expansion movement at end seats and center pier precludes pouring the railing entirely monolithic with rail posts and curbs.

The main feature of the railing design here shown lay in making every third post an expansion point for both sets of entering rails, intervening posts being poured integral with rails. A panel length was adopted such that the larger posts near abutments and pier were expansion points corresponding to joints between deck beams and abutments and wing-walls. The bottom rails in the two panels adjacent to each expansion post were separated from the bridge or wing-wall curb by ½-in. tarred felt. Freedom of movement of rails in expansion posts was secured by a tarred felt joint surrounding the sides and the end of the entering portion of the rail. The reinforcing for rails was continuous through those posts without joints.

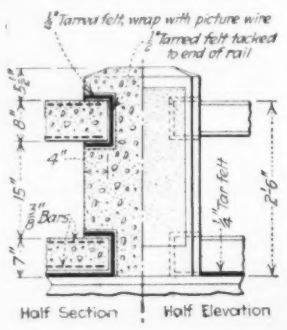


FIG. 2—DETAILS OF EXPANSION POST

Precast railing not being advisable for the structure in question, forms for all posts and rails on one side of the roadway were built at a time. After the shores under the bridge deck had been removed, all concrete for the side was poured except in expansion posts. Following a minimum set of four days the form construction in the interior of these posts was carefully removed from around the ends of the entering rails, tarred felt was applied around the bottom set of rails first, and then concrete was poured up to the top rails, whose ends were similarly protected, and the pouring was completed.

By compensating for deck movement and rail expansion proper in every third post, only ten expansion posts were needed for 215 ft. of railing, thus avoiding the questionable construction of an entirely rigid railing on a multi-span bridge while saving in construction time and expense as compared to a design using an expansion joint in every post.

The design presented was developed by the writer for federal-aid work in Hocking County, Ohio.

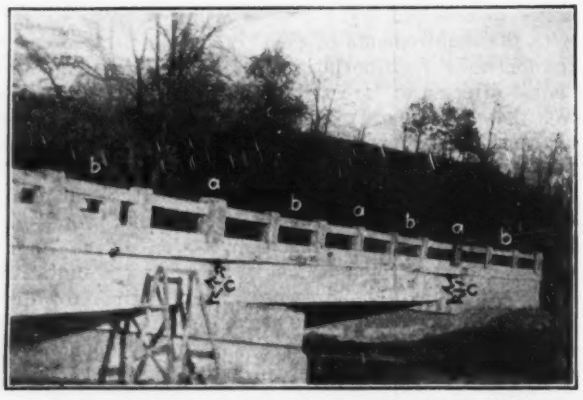
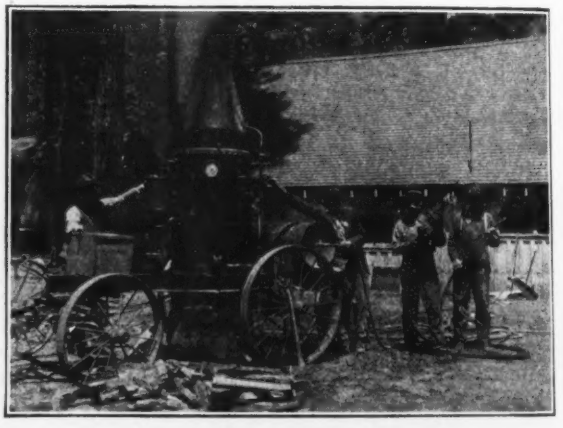


FIG. 1—LOCATION OF RAILING EXPANSION POSTS

Bunk House Sterilizer Uses Live Steam and Creosote Oil

A PIECE of apparatus has been built and is being used on the Big Creek project of the Southern California Edison Co. which has been found very effective in disinfecting dormitories and bunk houses in construction camps. The device consists of a 10-hp. vertical boiler, mounted on a steel wagon frame, and is fired with wood or coal, building steam pressures up to 110 lb. per sq.in. An old locomotive air compressor mounted on one side of the boiler is used to maintain a pressure of about 90 lb. per sq.in. in a reservoir fastened to the wagon frame on the opposite side of the boiler. A 10-gal. tank also attached to the wagon frame is used as a storage tank for creosote oil. Air pressure is admitted to this tank so that the creosote can be forced out as desired.



PORTABLE STERILIZER FOR USE IN CONSTRUCTION CAMPS

The device is arranged for operating two hose lines, one direct from the boiler for the use of live steam, and the other fitted with a combination nozzle taking air pressure from the air reservoir and creosote from the storage tank, the arrangement of the nozzle being such that the creosote oil is delivered in a fine spray.

Steam may be substituted for the compressed air in the combination nozzle.

When a building is to be treated by this method all contents are removed, including building paper or other wall coverings. The base boards, door, and window frames are also loosened. The entire interior is then given a thorough treatment with live steam, special attention being given to cracks and corners. Next, all surfaces are given a light coating of creosote oil by using the combination nozzle. After drying for 24 to 48 hours, according to atmospheric conditions, the building is ready to be re-equipped for occupancy.

The live steam kills all vermin and eggs, and the creosote oil, which impregnates the wood, tends to prevent the re-entrance of pine bugs or vermin. While the creosote jet is being used a fine vapor of creosote oil fills the building and if left closed it is untenantable for several hours. Operators must wear gas masks and can work only for short periods. The machine is towed from job to job by motor truck and requires three men in its operation: a fireman, operator, and helper.

> ***"Do you remember—"***
>
> Weather conditions will soon drive construction men and engineers, who have been working long hours on a thousand projects throughout the country, indoors. Reminiscence will replace actual experiences: and numberless conversations during the coming winter months will begin with:
>
> ***"Do you remember—"***
>
> In many instances the query will doubtless recall a particularly hard job solved through someone's ingenuity or quick thinking. *Engineering News-Record* invites its readers to translate such reminiscences into "copy." Potential *Job and Office* articles are frequently contained in a conversation which begins with:
>
> ***"Do you remember—"***

Laying Pipe in Unstable Soil

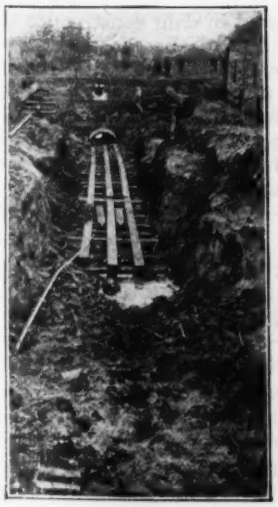
By McKean Maffitt
Superintendent, Department of Public Works, Wilmington, N. C.

IN CUTTING an open ditch recently for drainage purposes such unusual soil conditions were encountered that it became necessary to use large concrete pipe and then refill the ditch. The soil proved so unstable that backfilling became necessary as each short section of pipe was laid.

The average depth of cut was about 8 ft. with side slopes of 1 to 2. For about 5 ft. of the depth a stiff yellow clay was encountered which was most stable, but underneath this was a stratum of oozy blue clay which the upper layers of stiff clay forced out into the excavation, thereby throwing the ditch out of alignment and filling it up. In some instances the ditch filled 3 or 4 ft. overnight, and the sides settled nearly as much, leaving berms at the excavation's sides from 3 to 5 ft. wide.

To lay the pipe a 12x12-in. timber set upon a track was placed across the ditch. Lengths of pipe were lowered by a chain hoist suspended from the timber. The excavation was made large enough for the pipe, with an allowance for sliding. After the pipe was picked up by the improvised traveling crane and moved to within 4 ft. of final location the final excavation was made and the pipe lowered to grade and immediately covered with enough mud to hold it in place. In several instances the movement of the ground was so rapid that the crane settled with the banks and the process had to be repeated.

The usual day's run was from four to five lengths of pipe with one foreman and nine workmen, but in some cases the sliding of the earth was so troublesome that not more than one length of pipe could be laid.



LEFT—IMPROVISED GANTRY HANDLES PIPE LENGTHS
RIGHT—GENERAL VIEW OF DITCH

The stump in the foreground moved horizontally 3 ft. in one night. The berm at the side is about 3 ft. deep, and was formed the same night.

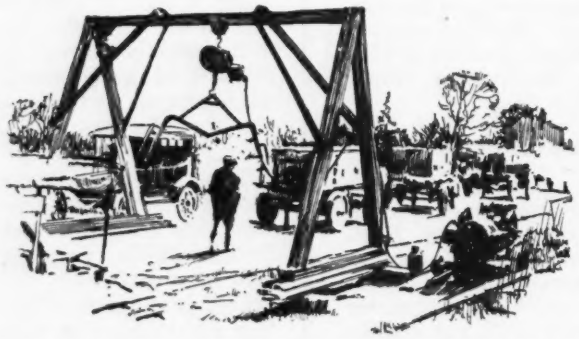
Light Gantry Used in Transferring Batch Boxes on Road Job

CONSTRUCTION of a 10½-mile concrete road in North Carolina, known as State Aid Project No. 533, involved some rather unusual difficulties due to the fact that the only available materials shipping point was one mile from the end of the road. This necessitated unloading of all concrete materials at a siding near where the job began and hauling preproportioned batches in steel boxes on motor trucks and trailers over as much of the concrete road as was opened to traffic and then transferring the batch boxes to industrial cars for transportation past the new pavement to the mixer.

In order to avoid turning the trailer around, the truck-trailer unit ordinarily continued past the aggregate bins and drew up at the cement shed, where four bags of cement were placed in each batch box on the truck. The truck was then uncoupled from the trailer and driven to the aggregate bins, where stone and sand were added. Meanwhile cement had been placed in the batch boxes carried by the trailer. The truck then backed up to the cement house, and was coupled to the other end of the trailer, which was then pulled up to receive the aggregates.

With paved streets and the concrete road to haul over, the trucks made good time en route to the transfer station where they stopped under a light gantry crane which carried a pneumatic hoist. The gantry spanned the concrete slab and the track of 24-in. gage along the shoulder. Lifting tongs suspended from the hoist were hooked into holes at the sides of the batch boxes, and they were quickly lifted and moved sidewise to position over an industrial car truck. When enough boxes had been transferred to make up a train load, the cars were pulled to the mixer by a gasoline locomotive.

According to a recent issue of *Concrete Highway*



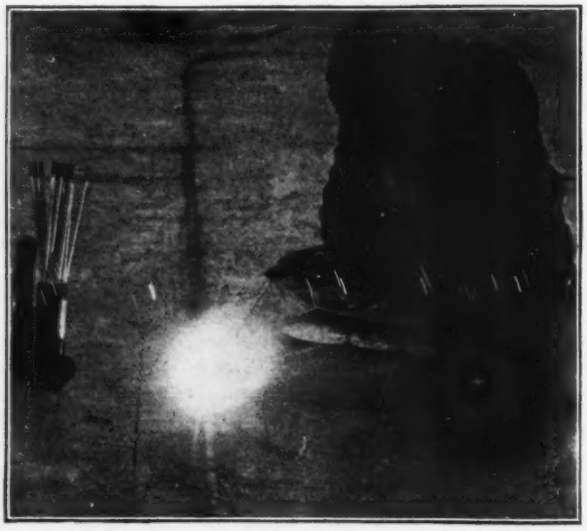
GANTRY MOVES BATCH BOXES FROM TRUCK TO TRAIN

Magazine, eight cars, each carrying two boxes, was a standard train, though on grades, of which there were several ranging from 3 to 5 per cent, the train length was cut as low as five cars.

The work was done by the Royer-Ferguson Co., Inc., of Roanoke, Va. John D. Waldrop, of Greensboro, N. C., was district engineer in charge of the work for the state.

Welded Tank Joints

A PROCESS of electric welding in the field for the joints of the large steel plates used for the bottoms and roofs of oil storage tanks is a new development in tank work which is being introduced by the Chicago Bridge & Iron Works, Chicago. For an ordinary 80,000-bbl. tank, 117 ft. in diameter, the ¼-in. bottom plates are



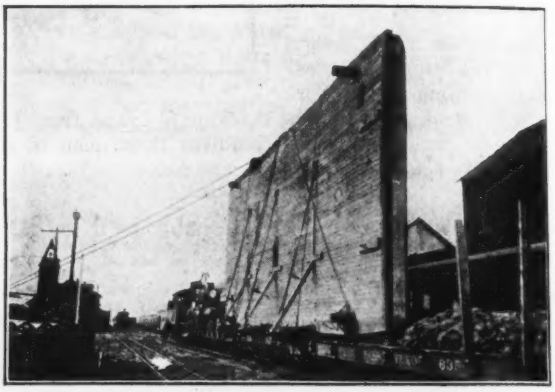
WELDING STORAGE TANK

From Job and Office

Hints that Cut Cost and Time

about 19x6 ft. These are assembled on a leveled surface and tack-welded to hold them in position while the regular welding is being done. The operation is said to be quicker than riveting and more fully to insure oil-tight joints. In the roof also, usually of ⅜-in. plate, it is easier to secure gas-tight joints for the roof itself and for the connection of the roof to the shell. Test specimens are said to have shown ample strength, and in tests continued to failure the break is often through the solid metal instead of at the welded joint. Around the tank bottom is welded an angle-iron ring, to the upstanding leg of which the first course of shell plating is riveted. In the same way the roof is welded to an angle-iron ring on the top of the shell. With the tank bottom laid on the ground for welding, it cannot be tested by filling with water after the first shell course is placed, as is done with riveted tanks in which the bottom is built on blocking to permit of bucking up the rivets from below. As an alternative, oil is pumped under the tank bottom and though only a light pressure can be obtained in this way, the method is considered sufficient to develop any leaks.

Up-ended Barge Moved 43 Miles by Rail



A BARGE, built to be used in dam construction on a stream flowing into Lake Labarge, Alaska, was recently moved 43 miles by rail. Being 21 ft. x 60 ft. in size the barge had to be upended as shown herewith. It was braced by 8 x 8-in. timbers resting on cantilevered beams, three braces being placed on each side of the barge. Additional ties were provided through use of rope lashes and turnbuckles.

Radiation Reduced by Aluminum Paints

The aluminum or bronze paint generally applied to radiators greatly reduces their effectiveness and makes it necessary to have a larger surface for the same heating effect, according to experiments performed by Dr. W. W. Coblentz of the Bureau of Standards. Dr. Coblentz finds that the heat radiated from an aluminum painted radiator surface is less than a third of that emitted by a radiator of the same size painted with a non-metallic paint, enameled, or simply allowed to rust

From Job and Office

For Contractor and Engineer

Finding Yardage in Circular Excavations

By W. F. Schaphorst
Newark, New Jersey

THE CHART herewith will be found convenient for quickly estimating the number of yards to be removed from any ordinary sized circular excavation. To use the chart simply run a straight line across from Column A to Column C and the number of yards is immediately given in Column B. For example, the chart shows 8,700 cu.yd. for an excavation 30 ft. deep and 100 ft. in diameter. The correct answer, making the actual computation, will be found to be 8,720, showing that the chart is surprisingly accurate as well as quick.

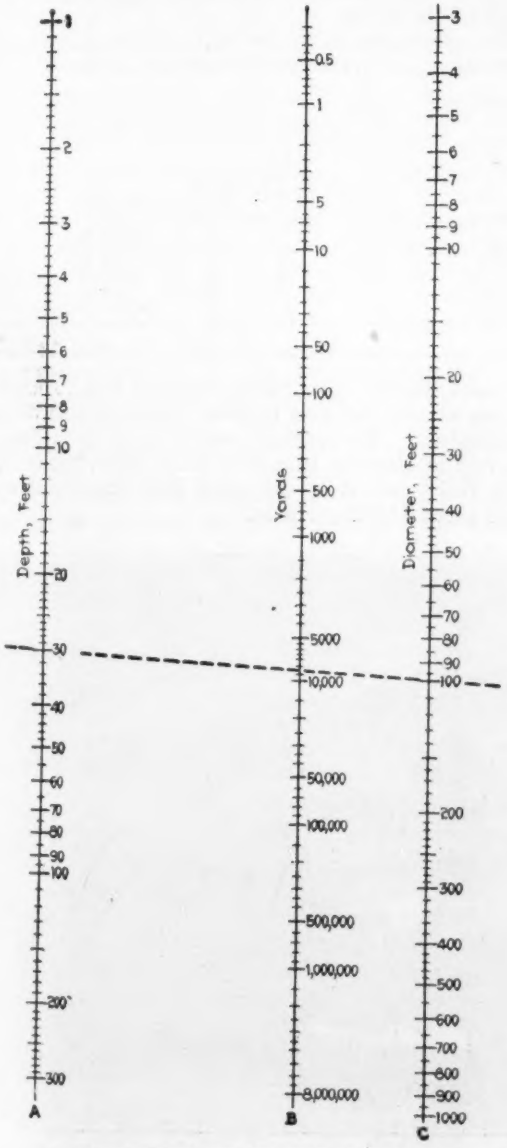


CHART GIVES EXCAVATION YARDAGES

The range of the chart as will be noted, is very great. It will take care of any depth of excavation from 1 to 300 ft. and any diameter from 3 to 1,000 ft. The maximum number of yards is 8,000,000.

The chart can be used as well for determining cubic contents of cylindrical tanks.

Bridge Fills Temporary Construction Use

TO transport material from the river bank to a cofferdam on a hydro-electric project at Gorham, N. H., the contractor, the Sanders Engineering Co., of Portland, Maine, constructed this simple suspension bridge.

Transporting 68-Ton Girders for a Chicago Building

ALMOST the largest steel girders ever hauled into the business district of Chicago for building construction were two 68-ton plate girders which were moved from railroad yards to the site of the new Straus Building at Jackson and Michigan Aves., on Sept. 9. These girders, which will be placed between the fifth and sixth floors and will support the steel frame over the main entrance, are 55 ft. long and 11½ ft. deep. It took practically all day to unload the girders from cars, transport them about half a mile and unload them at the building site.

A railway wrecking car of 150 tons capacity was used by the Chicago, Milwaukee & St. Paul Ry. to load the girders on flat cars at the Goose Island yard for transfer to the team yard of the Michigan Central R.R. at Michigan Ave. and South Water St. There a wrecking crane of the Illinois Central R.R. picked up each girder in turn, as shown in Fig. 1, and placed it on a special combination truck. This truck, shown in Fig. 2, consisted of a heavy drop-frame truck having its front end carried by the rear of a four-wheel tractor and having coupled on to its rear end a trailer with four wheels in a row on two short axles. Wide tires were used on all the eight load-carrying wheels, with ordinary tires on the front wheels of the tractor. About 42 tons or 62 per cent of the total load was carried by the trailer. For hauling such loads it has been usual to employ teams of 50 to 70 horses, but in this case two tractors rated at 40 hp. each were used. These tractors were placed side by side. One was an integral

FIG. 1—WRECKING CRANE HANDLES 68-TON GIRDER

part of the truck and the other was attached to the truck by a heavy chain.

It is stated that the only heavier girder handled in Chicago was a 70-ton girder for the Stevens Building. Two 63-ton girders were used in the Chicago Theater. The 68-ton girders were built by the Phœnix Bridge Co., Phœnixville, Pa., and will be erected by the Thompson-Starrett Co., which has the general contract. This company is using two large steel guyed derricks with 125-ft. masts and 115-ft. booms in the erection of the steelwork of this 32-story building for S. W. Straus & Co. These derricks swung the girders from the truck and will place them in position later.

The transportation of the girders was handled by the Pennoyer Merchants Transfer Co., Chicago.

From Job and Office

Hints that Cut Cost and Time

Cost of Ballast Cleaning: Santa Fe Ry.

FIGURES from work done with five of the Harris-Muff ballast cleaning machines on the Atchison, Topeka & Santa Fe Ry. indicate a cost of 25c. per cu.yd. In the accompanying table the cost is given per mile, and it is estimated that the ballast cleaned would approximate 2,500 cu.yd. per mile. This machine, described in *Engineering News-Record* of March 8, 1923, p. 468, consists of a rotary screen mounted on a small car and driven by a gasoline engine. Men shovel ballast from the track into a long trough having a belt conveyor which delivers it to the screen. The cleaned stone passes out through a chute to the track while the dirt goes to a lateral belt conveyor which discharges it clear of the track.

The work shown in the table covers a little over nine miles and represents an average section of 12 in. of stone ballast. The ballast between ties to level of bottom of ties and that on both shoulders was cleaned and replaced. No complete records have been kept of the cost of cleaning ballast by hand labor, handling it with forks, but it is estimated that this hand work costs about $1,500 per mile.

COST OF CLEANING BALLAST BY MACHINE

Division	Mile of Ballast Cleaned	Both Sides and Between Ties, Depth, In.	Average No. of Men in Gang	Total Cost	Cost per Mile
Eastern	2.73	9	18	$1,788.76	$655.22
Middle	1.77	12	16	943.45	533.02
Western	1.70	14	21	603.27	354.80
Panhandle	2.41	12	50	1,231.49	510.98
Albuquerque	0.52	8	18	997.77	1,918.79
Total or average	9.13	12	20	$5,564.74	$609.50

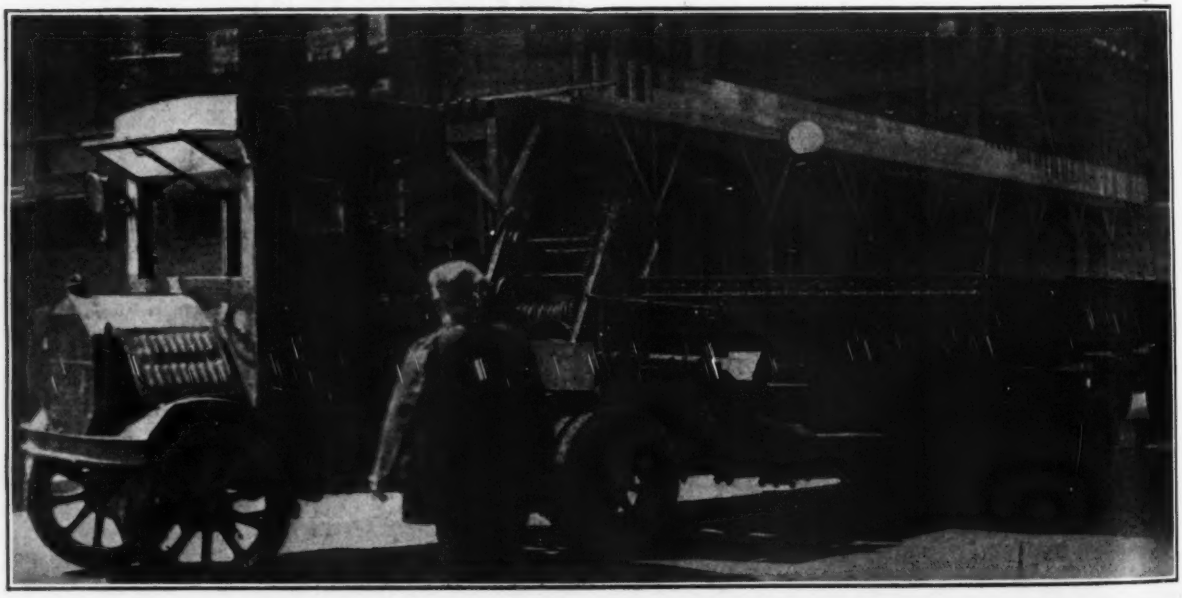


FIG. 2—TRACTOR-TRUCK-TRAILER CARRIES HEAVY GIRDER

From Job and Office

For Contractor and Engineer

Removing Rails and Restoring Paving at Everett

THE PUGET Sound International Railway & Power Co., operating the local transportation system in the city of Everett, Wash., completed in the month of August the removal of 10 miles of single-track line which has been superseded by motor buses. The city ordinance permitting the company to remove these rails has required that the paving be so restored that after the removal of the rails the portion of the street where the track formerly was located should have a surfacing equally as good as that in the remaining part of the street. The reconstruction of the paving has been done by a single crew divided into squads which followed one another closely so that a minimum length of the street would be torn up at one time.

The first or advance squad consisted of several men using picks, claw bars and shovels. The header bricks outside the rail were not disturbed, but the bricks on the inside were removed, spikes on the inner side of the rails were pulled, and the rails were removed and placed on the pavement alongside. All débris and loose paving was removed and piled on the street and the channels thus left in the pavement were brushed clean ready for surfacing material. The work of this crew was supplemented by trucks which hauled away the rails and piles of débris.

Following this advance squad came a four-man concrete crew with a small portable mixer pouring concrete into the trenches left by the removal of rail and brick. These trenches varied in width but averaged about 18 in. Where the ties were imbedded in concrete they were not removed and hence the depth of the trench was the same as the rail height. In pouring concrete in the trenches a ¾-in. tarred paper joint was put in at right angles to the street center line every 15 ft.

Where necessary, and this constituted a large part of the reconstructed pavement, a three-man asphalt crew followed the concrete squad, using a portable tar kettle and tool-heating rack. The work of this crew was chiefly with square-nosed shovels and hot irons patching small depressions or worn places in the line of header bricks or other parts of the surfacing.

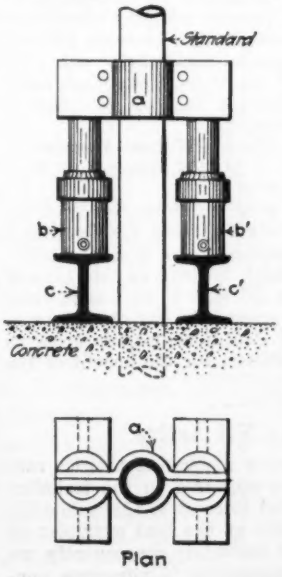
Laying Pipe-Line Under Panama Canal

A 20-in. pipe to carry water from the Rio Grande reservoir to the east bank of the Panama Canal under the Pedro Miguel locks developed a serious leak in April. As the line was embedded in the concrete of the locks the leak could not be located and repaired without keeping the west lock unwatered an indefinite time. In consequence a new line in another location at Paraiso, where formerly the pontoon bridge of the Panama R.R. crossed the canal, was chosen. Cast-iron screw pipe, 12 in. in diameter and 459 ft. long, was assembled in one section on the pontoon of the former bridge and dropped into a trench 5 ft. deep and 25 ft. wide. The ends projected out of the water at each bank and, according to the *Canal Record*, were found tight on test.

Drawings Which Fold to Letter Size—George C. Love, of Newport News, Va., submits a detail of office routine that should prove interesting to those who have in charge preparation of plans which must accompany letters to be sent through the mail. Often odd-sized maps arrive at their destination in bad condition, due to the fact that folding was of a hit or miss nature. Mr. Love finds that by employing the following outside dimensions, maps fold naturally into an 8½x11-in. sheet; 42½x55 in., 34x44 in., 25½x33 in. and 17x22 in. The title is at all times to be found in the lower right hand corner, and the blueprints are to be folded in such a manner that the title card is always visible.

Well Water Level Indicator With Telephone Attachment—Referring to the article in the "From Job and Office" section of *Engineering News-Record* last week, describing a method of discovering the water level in a well by means of a pocket electrical device, S. P. Baird, engineer with The Jennings-Lawrence Co., civil and municipal engineers of Columbus, Ohio, has suggested that a variation of these devices, two of which were described in *Engineering News-Record* several months ago, is secured by the use of an ordinary telephone receiver, high and low resistance coils, and a vibrator. Instead, therefore, of having to watch to discover when the water surface is reached, when the exposed end of the wire touches the water the telephone emits a sound like an auto horn. The sound from the receiver can be stopped or started by raising or lowering the wire ⅛ in.

Removing Old Tramway Standards—Removal of old trolley-wire standards may often necessitate breaking up by hand the concrete blocks in which they are usually embedded, but a more effective method is removal by means of two small hydraulic jacks and a portable hydraulic pump as described by an English correspondent. Referring to the sketch: Bearer-plate *a* is bolted to the standard at a suitable height from the ground and under each end of this one of the jacks is placed as shown at *b* and *b'* on two short lengths of I-beam, *c* and *c'*. Forcing water into the rams causes the pole to be ripped out of its foundation but in a steady noiseless manner and when the full stroke of the rams is reached the bearer-plate is lowered down the standard and the process repeated.



Welding Lugs on Sections of Artesian Well Casing—Instead of the usual screw joints used in connecting sections of artesian well casing, a contractor drilling a well in New Jersey recently conceived the idea of applying oxyacetylene methods of welding lugs to pipe sections. The well required nine 20-ft. lengths of steel pipe 18 in. in diameter with walls ⅝ in. thick. In accordance with plans worked out in the shop, four lugs 1½ in. x 8 in. x ⅞ in. thick were welded on the outside of one end of each section of pipe with half the length of the lug extending beyond the length of the pipe. The lugs were so fastened that a pipe section fit inside of the next successive section, holding the pipe in a perpendicular position while being sunk. This suggestion for artesian well contractors is contained in a recent issue of the house organ published by the Linde Air Products Co., New York.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Shaded Topographic Maps

Sir—An erroneous impression is given in your issue of Sept. 6, 1923, p. 382, that there is something new in the idea of a shaded topographic map. It may be new to the Geological Survey but not new to the Corps of Engineers. The current issue of *The Military Engineer* contains an excellent description by Major A. M. Walker of the work now being done at the engineer reproduction plant at Washington in the production of contour maps with shaded relief and an account of French army map work as developed during the war. The French army maps of 1912, scale 1:200,000 printed in four colors, use shading to bring out the relief as shown by contours. The new series of eastern France, scale 1:50,000, begun in 1914 and not completed by 1918, show the same system much improved and permit an excellent visualization of the terrain.

They give also, what the Geological Survey maps omit, all forested areas in green as well as cultivated areas shown by appropriate marking, thus conveying much more information to the map user than can be obtained from any maps available in this country.

Admitting all the well-known reasons why our country has not yet been mapped as thoroughly as Europe, there should be no reasson why our present mapping should not equal theirs in quality. Perhaps a little team-work between different government departments could help out. At present it would appear as if the War Department could give a tip or two to the Geological Survey. It certainly could in the use of durable paper.

Sandwich, Mass., Sept. 15, 1923. HENRY WELLES DURHAM, Lt. Col. Engr. O. R. C.

[It was not our intention to give the impression that the shaded topographic map was new to either the Geological Survey or to the Corps of Engineers, for it is our belief that both these agencies have been working on this type of map since war days. What we did wish to do was to draw the attention of engineers in general to the shaded topographic map as a new type of U. S. G. S. map in order to draw out some constructive criticism for the benefit of the Geological Survey.—EDITOR.]

Concrete Borers Not Active

Sir—During the current year a number of articles concerning "concrete borers" have appeared in the technical press. The subject is of general interest to the public because concrete is considered one of the best examples of a hard, enduring, all-resisting material; consequently we find references to the borers appearing in numerous non-technical magazines and newspapers.

There has been a wide range in the interpretation of the extent of the observed work of the borers. The most pessimistic would have it that all concrete is doomed when placed in water infested with them. The writer recently had the opportunity of inspecting concrete at a number of points along the coast of California and is very optimistic concerning this threatened scourge of concrete in sea water.

At La Jolla near San Diego there is a concrete pier at the Scripps Institution for Biological Research. This should be an excellent place to obtain information, but inquiries revealed that while the borers are numerous in the locality and can be easily located in the shale cliffs none have ever been found in the concrete.

At San Pedro the borers are found in only one locality in the harbor and the writer was told that considerable time would be required to find any of them.

The borers are known to be present in San Francisco Bay, but according to engineers of the California Harbor Commission no concrete has been found attacked by them.

Chicago, Sept. 10, 1923. J. C. WITT, Structural Materials Research Laboratory.

The Right Way to Help the Japanese

Sir—I wish to voice my hearty approval to your note to Dr. Waddell's letter published in the issue of Sept. 6, 1923.

My experience in France and Italy during the late war and the personal contact I had with engineer and architect refugees from the invaded zones lead me to think that having passed the first short period following the calamity our colleagues' desire is not to have the little financial help which the more fortunate colleagues can give, but opportunity to work and provide their own livelihood.

It seems to me the Japanese have plenty of work in their own country provided they have the means to go ahead with the rebuilding of their devastated cities. What they will need most are the materials and machinery for their work.

It is admitted that most of the materials and machinery will have to come out of the United States. And here is where we engineers, manufacturers and dealers on these goods can help them, and helping them help ourselves with no injury to anyone.

We note already an increase in price of the very goods most needed.

Here is where we can serve. Let us sound a clarion note to be heard all over the world that any increase of price in the line of goods needed in Japan is not justified by any economic reason but is the consequence of the greed of the manufacturers, merchants, and transportation companies, and will result in defeating our noble purpose of helping Japan and be very serious to our industries.

With the exception of wheat there is ample margin of profit with the present prices, and this profit will be greatly increased with the increase in the volume of business. Let us distribute our production throughout the entire year. Let us take advantage of this opportunity to fill in the gaps on the production year, and everybody will be better off, and we shall surely help not only our Japanese colleagues, and their fellowmen, but our own people as well.

I am tempted to comment more fully on this topic, but I think I have said enough. Let us work hard at it in true patriotic American spirit.

Birmingham, Ala., Sept. 15, 1923. FRANCESCO MAURO, Engineer and Architect.

Water Economy of Ash Pits

Sir—Referring to the abstract of report of the A.R.A. committee on Engine Terminal Design, page 424 of the Sept. 13 issue of *Engineering News-Record*, there has been a great deal written, published and read before societies in recent years about railroad terminal design, dwelling largely on capacity, equipment and economy, describing in detail the design of terminal, enginehouse, turntables, coaling stations, cinder pits, etc., but not a word on an economical water service to cinder pits.

Why stop part way on the subject of economy? Do the engineers and designers *know* the difference between an economical cinder pit hydrant service and a wasteful layout? There is a difference and a big one and I am sorry to say from twenty years of close observation of this subject that very few do. True, most engineers know that all water to railroad terminals is metered, but that does not mean that the meter is considered—waste goes on regardless because of the absence of a preventive.

I know of many instances, one in particular, where the water engineer put his economy program into effect down to the smallest hydrant, including the cinder pit hydrants, and caused a saving of some $30,000 in metered water in the city of Chicago. This same practical water-works engineer extended that hydrant economy program to all parts of his road with an unprecented record in economical water service.

Stapleton, N. Y., Sept. 15, 1923. WILLIAM VOLKHARDT, President, Volkhardt Co., Inc.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Four Killed in Explosion at Bureau of Standards

Washington Correspondence

No official information is yet available as to the cause of and the responsibility for an explosion in the dynamometer laboratory of the Bureau of Standards on Sept. 20, resulting in the death of four employees and injury to six. The coroner's jury pronounced the death of the victims to have been due to "an accidental explosion of gasoline and air mixture in the altitude chamber."

The dead are Logan L. Lauer, assistant physicist; Urvan J. Cook, machinist; Stephen M. Lee, mechanical engineer; J. E. Kendig, assistant electrical engineer. Among the injured Herbert K. Cummings, an associate physicist, continues in a critical condition.

An exhaustive investigation of the accident is proceeding as rapidly as possible but no announcement will be made until the investigation is completed. It is expected, however, that the investigating committee will find that the cause of the accident was due to leakage of gas fumes from the engine that was being tested.

Secretary Hoover referred to the dead as "martyrs to science." The damage done to the building can be repaired for less than $10,000. No important delay will take place in the testing of airplane engines.

It is pointed out that this accident will tend to emphasize the importance of the resolution adopted by the executive board of the American Engineering Council at its meeting in Cincinnati on March 23. In that resolution, it was pointed out that the government "is paying heavily in the form of employees' compensation, as well as in loss of time and efficiency, for its failure to adopt a thorough-going safety program." Attention is called to the fact that the government falls far short of the standard set by many private employers, the more progressive states and some of the municipalities. Federal safety standards were drawn up during the war, but there is no officer having the authority to enforce such standards, the resolution states.

Federal Permits Granted for Two San Francisco Bay Bridges

Permission has been granted by Secretary of War Weeks for the construction of two vehicular bridges across the lower end of San Francisco Bay, one to Frank Eldridge Webb, to have its western end at Little Coyote Point, and the other to John Lyle Harrington for a bridge at Dumbarton near the site of the present railroad bridge. Franchises for both these bridge projects have already been granted by San Mateo County. A résumé of the discussion about the two bridge sites was published in *Engineering News-Record*, Sept. 7, 1922, p. 411.

Steel Frame and Reinforced Concrete Structures Survive Japan's Earthquake

Refugees Arriving in Seattle Sept. 16, Tell Special Representative of "Engineering News-Record" Details of Disaster

By W. A. Gleason
Port of Seattle Commission, Seattle, Wash.

When it was learned that the first refugees from the earthquake-stricken cities of Japan were due to arrive in Seattle, Wash., Sept. 15, "Engineering News-Record," through the co-operation of George F. Nicholson, chief engineer of the Port of Seattle, arranged with W. A. Gleason, a member of his staff, to board the "President Jefferson" as soon as she should dock and secure from such engineers as might be among her passengers information regarding the effect of the quake on the engineering structures in Tokyo and Yokohama. Mr. Gleason undertook this assignment as the special representative of this journal; his report follows.—Editor.

FOLLOWING the receipt of your telegram on Sept. 12, I made arrangements through the traffic manager of the Admiral Oriental Line to meet the ship *President Jefferson* due to dock in Seattle, Sept. 15, with the first group of refugees to reach the United States from the cities of Japan devastated by the earthquake of Sept. 1. On Sept. 14 I lunched with an American engineer who returned from Japan in 1920. He acquainted me with the geography of the territory in the earthquake zone and with the character of some of the engineering structures. Additional information was secured from Mr. Shivagaki, Seattle manager for Mitsui & Co., Ltd.

The *President Jefferson* was reported due at Seattle at 11.30 p.m. Sept. 15. I reached the dock at about 10 p.m. where I learned that the boat was expected to arrive about 3.30 a.m. Sunday, so I returned home for a few hours' sleep and was back at the dock at 7 a.m., before the refugees not on stretchers came off the ship. I passed the outer guard successfully but the guard at the gang-plank insisted that none could pass without a permit from the manager or the customs collector. The manager was not there as agreed, but by interviewing one of the refugees I learned the name and room number of "just the engineer you want." I was permitted to send a message to him, with the result that he promised me an interview the following day. He was too busy that day with another engineer in connection with a hospital for the wife of one of them. However, I met both of these engineers and also a college professor who was hurrying to make train connections. Although provided with a list of all engineers aboard and although I approached each person as he had his baggage inspected, I did not meet more than the aforementioned three. Sunday evening I was granted an interview with the two engineers in a local hotel. The following notes summarize their statements regarding the effect of the earthquake in Yokohama and Tokyo:

In Yokohama

The reinforced-concrete skeleton of the Russo-Asiatic Bank Building, three stories high, remained after shedding its coat of stone and brick. The heavy timber and stone Thomas Cook & Son Building was completely wrecked and every human being within lost.

The masonry walls of many buildings withstood the earth shocks while their floors and roofs were precipitated to the ground.

The six-story Telephone Building with steel skeleton frame withstood the earthquake.

The breakwater in the harbor disappeared except its ends, which remained with their lighthouses erect.

A dock with reinforced-concrete deck lost about ¼ mile of its length, while about 600 yd. remained standing. The details of the underpinning of this dock were not observed.

A reinforced-concrete locomotive roundhouse remained standing and without a noticeable crack, while across the turntable the earth was badly fissured and sunken.

(*Continued on p. 531*)

Real Progress in the Development of the Port of New York

The second joint hearing of the Interstate Commerce Commission and the Port of New York Authority at which the railroad companies having terminals on the west side of the Hudson River at New York were called upon to show cause why the port authority's proposed marginal railroad on that side of the river should not now be made effectual, has ended in an unexpected and promising way. From an attitude of being openly hostile to the proposed belt line at the hearing last spring the railroad companies have come forward with a plan for operating it and have outlined certain improvements in the existing tracks which they think should be made. This change of front made a continuation of the hearing unnecessary at this time, consequently it has been indefinitely postponed while the railroads and the Port Authority get together and outline the manner in which the belt line will be made up and operated. The details of the proposals of the railroads and their relation to the plan of the port authority will be given in next week's issue.

Binghamton Brick and Tile School Building Fails

Investigations May Show Removal of Supports Under Green Concrete, or Weak Tile Wall, to Blame

Special Correspondence

The Daniel S. Dickinson School, a 40-room, three-story grade school under construction at Binghamton, N. Y., failed just after workmen had left in the afternoon of Sept. 18. The portion of the building which collapsed included an area in plan about 60 ft. x 75 ft., comprising the external wall and two interior walls from the roof to the basement. Estimates of damage have been placed anywhere from $20,000 to $80,000.

Rudolph P. Miller is investigating the failure for the city authorities. Investigations to date from others have tended to narrow possible failure to two causes: premature removal of wooden supports from under fresh roof concrete, and structural weakness of one of the interior tile bearing walls. The supports for the concrete floors and roof consisted of two 2 x 4-in. pine timbers, spiked together in the form of "T's" and spaced on an average of 4 ft. 6 in. across the rooms and 5 ft. 6 in. along the rooms, each support thus carrying about 25 sq.ft. of roof or floor. The supports were from 13 to 15 ft. long and were supported at about mid-height by 1 x 8-in. braces in each direction. They were capped along the long dimension of the room by 2 x 6's. About half the supports under the green roof concrete had been removed prior to the pouring of the roof.

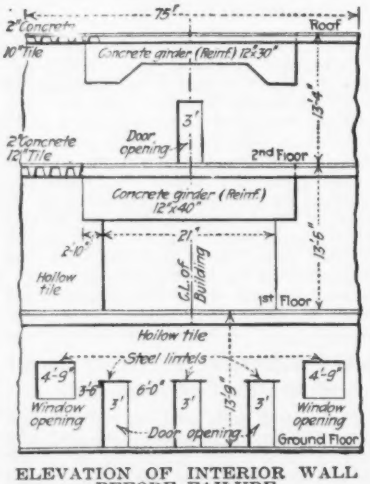
If failure occurred in any of the interior walls it was probably in the first wall inside the enclosing wall. This wall was 26 ft. in from the exterior wall and parallel to it, and was of 12-in. tile. It was pierced by numerous openings as shown in the accompanying figure. It also included the rather peculiar feature of a 30-in. concrete girder resting on it and extending partially along its top. The failure was so complete it will be difficult to decide which of these causes may have been responsible, if either.

Cause Yet Unknown

No definite decision as to the cause of the failure has yet been reached due to the completeness of the failure and the danger of further collapse of portions of the front wall. Workmen refuse to start the demolition from scaffolds of such portions of the front wall as remain standing and the city is unwilling that any more wreckage be added to the mess in the building until every effort has been made to establish the responsibility. The contractors will attempt to remove the dangerous portions of the wall by means of derricks.

Exterior walls of the building were of interlocking tile with a brick facing and interior walls were of tile. Exterior walls were 16 in. thick from the basement to the first floor and 12 in. thick from there to the roof. These thicknesses included the brick facing. Interior bearing walls were 12 in. thick, except for one 8-in. wall extending from the second floor to the roof. This 8-in. wall was not completed when the failure occurred. Specifications provided that these walls should be laid up in cement mortar and that in portions subject to heavy bearing the tile should be filled with concrete or the space laid up with brick. A subsequent agreement required the brick veneering to be bonded into the tile by a header course every seven courses.

Floors of the building were of the steel-pan concrete type, the pans being 10 in. and 12 in. and covered with a 2-in. concrete slab. Over the corridors



ELEVATION OF INTERIOR WALL BEFORE FAILURE

the pans were being removed for the most part for reuse. At the time of failure the first floor had been placed about three months and the second floor about six weeks.

Proposals for the construction of the school were received by the City on December 20, 1922. Five contractors submitted figures for the general construction work, the bids ranging from $329,700 to $426,700. The work was awarded to the low bidders, Kirkpatrick and Stento of Binghamton, their proposal being $26,255 under the next lowest figure. Construction was started early in the Spring and the work was progressing in a fairly satisfactory manner.

The building was designed by Dickerman and Bartoo, Binghamton architects, and the building was being constructed under their supervision.

Bayonne, N. J., Rejects Proposal for Shipping Terminal

The $150,000,000 shipping terminal and industrial center proposed for Bayonne, N. J., has been rejected by the board of city commissioners on the ground that the bond offered by the New York Port Terminal Co. is inadequate. The project has received considerable publicity as it is reported to be backed by William B. Franklin, brother of P. A. S. Franklin, president of the International Mercantile Marine; Gen. Wiliam M. Black; and William Coyne, vice-president of the du Pont de Nemours Co.; John G. Gray of Wilmington, Del.; and Henry J. Hemmens of New York.

The objection to the bond is made on the basis of the fact that under the proposed agreement the city is required to issue $20,000,000 worth of bonds with an annual interest rate of $1,200,000 and that the bond offered by the company would only pay this interest for a few months in case of default.

Convention of New England Water Works Men

Forty-Second Meeting Held at Burlington—Business Proceedings—David Heffernan President

Engineering News-Record Staff Report

After a lapse of 28 years the New England Water Works Association met last week for the second time at Burlington, Vt. About 400 members and guests were registered. The Water Works Manufacturers Association provided an all-day visit to Au Sable Chasm, reached by boat across Lake Champlain.

At the opening session honorary membership was conferred on John R. Freeman. The Dexter Bracket medal was awarded to Charles W. Sherman, of Metcalf and Eddy, Boston, for his paper on "The Proper Term for Which Water-Works Bonds Should Run"—printed in the *Journal* of the association last December.

The tellers' count showed that 419 ballots had been cast and that the principal officers elected were: President, David A. Heffernan, Milton, Mass.; vice-presidents, Theodore I. Bristol, Ansonia, Conn., and Stephen H. Taylor, New Bedford, Mass.; and treasurer (re-elected), F. I. Winslow, Framingham, Mass.

President's Address

The chief feature of the address of the retiring president, Percy R. Sanders, Concord, N. H., was the experience of the association as one of the nine organizations composing the Affiliated Technical Societies of Boston. Before the affiliation the association employed an assistant to the secretary, at a salary of $1,200 a year, and rented quarters in Tremont Temple, Boston, at $750 a year, making a total of $1,950 for these two items. Since the affiliation the assistant secretary has been clerk of the affiliated societies and is paid by that organization. The headquarters are unchanged. The association pays to the affiliated societies $3 per member with adjustment for duplicate membership. For the year ended May 31 these payments totalled $1,983 as compared with $1,950 previously paid for rent and assistant secretary.

The membership of the association was 1,043 on Jan. 1, 1917 and on Sept. 1, 1923, it was 769, a loss of 274 members. During the year the association lost by death Rudolph Hering, honorary member, and Lewis M. Bancroft, treasurer.

Secretary's Report

The report of the secretary, Frank J. Gifford, Dedham, Mass., showed a net membership loss of 59 during the eight months ended Sept. 1. Some of this loss is due to the annual dropping of members for non-payment of dues which will be partly made up before the full calendar year has been completed. The association year begins Sept. 1 instead of Jan. 1 under recent changes to the constitution. The report of F. I. Winslow, treasurer, showed a substantial balance both in ready cash and in invested funds. The net cost of the *Journal* for the year according to the report of Henry A. Symonds, editor, was $341.

The technical proceedings of the convention will be found on p. 515.

Am. Soc. C. E. Announces Fall Meeting Program

Highway Engineering Transport and Port Problems Are Chief Topics of Discussion

Highway engineering and transport problems and special sessions by the power and highway divisions of the society, together with a full discussion of Norfolk's port problems and the development of Hampton Roads, Va., comprise the technical features of the fall meeting of the American Society of Civil Engineers to be held in Richmond, Va., Oct. 17-20. Not all of the time will be spent in Richmond as excursions have been planned to include Norfolk and Washington, D. C., Oct. 19 and 20. In addition to the technical discussions, there are the usual social features, and numerous excursions to various points in historic Virginia have been planned.

The morning session on the first day will be called to order by James A. Anderson, associate professor of civil engineering of the Virginia Military Institute, who will be followed by Governor E. Lee Trinkle, who will give the address of welcome. A response by Charles F. Loweth, president of the society, will follow.

Group of Highway Papers

The following highway papers will be delivered: "Fundamental Principles of Highway Financing," by Thomas H. MacDonald, chief, Bureau of Public Roads; "Road Service in Industrial Regions," by George E. Hamlin, of Hartford, Conn., superintendent of repairs of the Connecticut Highway Department. Various short discussions will follow these speeches.

C. M. Upham, chief engineer of the North Carolina State Highway Commission, will read the principal paper at the meeting of the highway division in the afternoon of Oct. 17. "Development of State Highway Systems" will be his topic. At the meeting of the power division at the same time, "Interconnection of Southern Appalachian Power Systems" will be the principal paper and will be read by W. S. Lee, of Charlotte, N. C., chief engineer of the Southern Power Co. and of the Quebec Development Co.

Will Discuss Norfolk's Port

The morning session on Oct. 18 will be given over to the following papers: "The Port Problems of Norfolk and Vicinity," by Homer L. Ferguson, president of the Newport News Shipbuilding & Drydock Co.; "Norfolk's City Plan in Relation to Its Port Development," by George B. Ford, New York, president, National City Planning Conference; "The Railways' Part in the Development of Hampton Roads," by Charles S. Churchill of Roanoke, Va., vice-president of the Norfolk & Western Ry. Following these will be given a paper on the "Program and Results of the Research on Structural Design of Roads by the Bureau of Public Roads," by A. T. Goldbeck, in charge of tests, U. S. Bureau of Public Roads, Washington.

On the trip to Norfolk and Washington stops will be made at Norfolk Army Base, Hampton Roads Naval Base, including the submarine base, the training station, the aviation station, and the supply base. The party will then be shown around the harbor on government and harbor tugs, visiting the Portsmouth Navy Yard, the naval hospital, and the coal piers of the Norfolk and Virginian Rys. The next stop will be at Old Point Comfort. From there Yorktown will be visited and then the party will pass up Chesapeake Bay and the Potomac River to Washington, D. C. One of the most interesting of the trips in Washington will be a visit to the Arlington Experiment Station, U. S. Bureau of Public Roads.

Coal Commission Urges Supervision of the Industry by Commerce Commission

Final Report Summarizes Previous Reports—Recommends Action by Government, the Industry, and the Public

The United States Coal Commission selected by the President on October 10, 1922, has given nearly a year to collecting facts concerning the industry and to the study of the data so gathered. During that time it has submitted numerous reports dealing with various phases of the industry and now it has concluded its work by submitting a final report to the President and Congress. This report is abstracted below.

Both to protect the public and to promote the normal development of coal mining as one of the great basic industries of the country, the Coal Commission in its final report recommends the use of the powers of the federal government over interstate commerce by the creation of a division of the Interstate Commerce Commission to exercise the necessary administrative and quasi-judicial functions required for the coal industry. "The function of the government is that of supervision, with substantial powers of regulation. The same principle has been applied for a longer time to the railroads and this may be regarded as the characteristically American and constitutional method of dealing with such a national problem as is now presented in the coal industry. The commission has aimed to make such proposal as will increase rather than decrease the sense of responsibility within the industry. A legitimate pride in workmanship, in fair practice, in operating and commercial enterprise will be developed not by taking over from an industry its own natural functions and placing them in the hands of the government, but by such measures as will insure public knowledge and will create public confidence that abuses are in a fair way to be removed, and that service is constantly improving. This means drastic regulation when necessary as a last resort for those who will not voluntarily give the service on reasonable terms; but it means also a reasonable attitude on the part of the government and the public toward investors who risk their capital either in operating or in marketing, and toward miners who risk their lives in a laborious and hazardous occupation."

The commission goes on to say that it realizes that it is passing upon an economic fact and not upon a law, and that the government can act only through administrative agencies, that if anything is to be done an effective agency with sufficient funds, experience, and powers at its disposal must be charged with the direct responsibility for such regulation and supervision. It believes that the logical and appropriate agency to exercise the necessary administrative and quasi-judicial functions already exists in the Interstate Commerce Commission. "The regulation of commerce in coal involves the right to know the cost of its production, whether the investment on which a return is claimed is fairly estimated or inflated, and what profits are made by owners, operators, and the dealer, and what are the earnings and working conditions of the miners."

Under the proposed arrangement the whole responsibility for the administrative correction of abuses, the regulative function, will be placed with the Interstate Commerce Commission and the fact finding and interpretation of the facts might be divided between the Geological Survey and the Bureau of Mines.

The first step toward the protection of public interest in the mining and marketing of coal will be the publication of facts concerning the industry so that the people will be able to exercise wisely the power of government over this type of private business. Both the government and the leaders

Fire Sweeps Thirty-Seven Blocks in Berkeley, Calif.

Special Correspondence

Thirty-seven city blocks in the residential district of Berkeley and joining the University of California campus were swept clean by fire on Sept. 18 when a strong wind drove a brush fire from the hills into the city. Averaging the value of the 640 buildings destroyed at $7,000 each the total structural loss is estimated at $4,500,000. The district burned was exclusively residential containing practically no fireproof construction. The destruction was complete, only brick chimneys were left standing in the path half a mile wide along which the fire advanced for about three-quarters of a mile. There were no fatalities.

The striking feature of the fire was the rapidity of its advance due to a strong wind which carried burning embers to dry shingle roofs, repeatedly causing roofs in an entire block to blaze up almost simultaneously. Firefighting equipment was sent in from neighboring cities and dynamite was used to raze buildings in the path of the flames, but the fire advanced steadily until the wind abated. There was ample water in the reservoir but due to the failure in recent years to meet needed increases in the distribution system the amount of water delivered was inadequate and at some points the supply failed altogether.

Conclusions are that fire breaks must be provided to keep brush fires from residential districts and that a fire advancing along a wide front with a strong wind in such a district is at best extremely difficult to check, and without adequate water will be beyond control.

of the coal industry will then be responsible if the public has no proper conception of what coal means to the country, what conditions have to be met in the mining and distribution of coal, what economies can be effected, and what advance is needed for bettering the working conditions of the miners. Such publicity will make it possible for the consumer to judge whether a fair price is being charged for his coal, and to form a judgment as to the equities of disputes between operators and miners over the renewal of wage agreements.

Use of Federal Powers—But the government, according to the commission, to fulfill its obligations to the people must go beyond continuous fact finding and publicity. It must regulate and supervise. "In the anthracite industry, the fundamental evil is monopoly—the treatment of limited natural resources as if they were like other private properties." This industry has been stabilized but at a high cost to the consumer and with such inequalities in the wages of the miners as to require a thorough revision of the wage scale. The special report on anthracite disclosed these conditions as well as excessive royalties and differential profits. These disclosures demonstrate the necessity of "limiting the margins to a reasonable return on legitimate investment and the elimination of monopoly profits.

"One remedy, short of price fixing or public ownership, remains in the hands of the government for the protection of the public interest. This is the levy of a graded tax on royalties and differential profits. This would not lower the price of coal, but would secure a public revenue without increasing the price of coal. The present sales tax imposed by the State of Pennsylvania on anthracite gives no such protection, . . . since it is a percentage on the f.o.b. mine price . . . and is therefore passed on to the consumer in the form of still higher prices. An excess profit tax, . . . under these monopolistic conditions, would not be added to the price of coal . . . as it would only fall on those who have differential advantages.

"The main remedy, however, against extortionate prices lies in the consumer himself. There are substitutes for hard coal and a readiness to resort to them is the ultimate and effective defense against an unreasonable price."

In the mining and marketing of soft coal which "from the point of view of national economic life is the more important industry has the fundamental evils of overdevelopment, and irregularity of operation, and consequent enforced idleness of the miner and the invested capital. This problem can be solved by the federal government . . . through the granting or withholding of transportation service and the consequent establishment of an equilibrium between demand and output.

"The most convenient and practicable of the various possible methods of exercising the right of control over the interstate commerce in coal would appear to be the licensing of all who desire to ship coal from one state to another or to buy and sell in interstate commerce, whether as operators, wholesalers, or jobbers. Reasonable conditions . . . would naturally be attached to the granting of the license and violation of them would be cause for suspension or revoking the license."

General Recommendations—The commission's findings of fact and its conclusions based thereon have been given in a number of preliminary reports dealing with both the anthracite and the bituminous industry, and appendices to these reports and on other subjects resulting from the commission's studies will be transmitted to Congress at a later date. This final report summarizes the recommendations already made and concludes with three general recommendations made to the parties in interest, namely, "the general public in its governing capacity, whether represented by Congress or other legislative bodies; second, the coal industry itself — operators, mine workers, and retail and wholesale dealers; and, third, the great body of coal consumers—railroads, public utilities, and the millions of citizens who buy coal. These general recommendations are (1) governmental actions; (2) actions by the industry, and (3) actions by the consumer."

Governmental Actions—This first recommendation of the coal commission is that Congress make definite provisions on a permanent basis for continuing the collection of coal facts by the Interstate Commerce Commission, as outlined above, and the determinations by Congress under what conditions the products of these mines may pass in interstate commerce. The river movement of coal, considerable at one time, but since discouraged by artificial rail rates, would help to get more coal to market with less coal cars. "Economy in the use of transportation also demands that the long haul of coal be no longer encouraged by favoring rates established without adequate regard to the cost of the transportation service rendered." In order to furnish "an economic incentive for regular, off-season purchase and storage of bituminous coal, thus increasing the length of the average working year for both miner and mine and so reducing the cost of production, the controlling influence should be given to the commercial factor in the distribution of railroad cars to coal mines in times of transportation shortage. By this change in practice, first consideration would be given to the commercial ability of the producer to sell coal rather than to mere ability to produce and load it into railroad cars.

"As administrator of the public estate which includes 50,000,000 acres of coal land . . . the federal government has a direct responsibility in restraining overdevelopment . . . and should amend the leasing law to give the Secretary of the Interior full discretion to make his approval of the opening of a new coal mine . . . contingent on the showing before the Interstate Commerce Commission that such a mine would serve the public and not involve a needless investment and excessive cost of operation."

The commission also recommends that Congress designate an agency to unite with the industry in continuing studies of unemployment, of the rate structure, and serving as a medium of publicity for all basic facts on which industrial relations depend. Such an agency would best be prepared to make special compulsory investigations whenever the prospect of failure to renew an agreement is imminent. In all the investigative work relating to mining it recommends that the federal government should continue to co-operate with the state governments in inspection, revision of mining codes, supervision of compensation insurance, and in safety education, and should see that state inspection is freed from politics, that some state codes are revised, and that the regulations of the Bureau of Mines are rigidly enforced.

"The consolidation, grouping or pooling of bituminous mining operations should be not only permitted but encouraged, with a view to securing more steady production, less speculative prices, a wider use of long-term contracts with consumers, better living conditions, more regular employment, and lower cost. The existing legal barriers to such an economic arrangement should be removed, retaining, however, the necessary protection to the public interests, by requiring supervision of the financial structure of the consolidation as is prescribed in the Transportation Act for railroad consolidation.

"There is neither constitutional nor economic warrant for the federal government undertaking the distribution of coal in the several communities of the country. . . . Therefore, it is the function of each community by licensing retail coal dealers, by organizing co-operative associations, by establishing municipal fuel yards, . . . to take the necessary steps that after the coal reaches the railroad siding the distribution thereof is made to the consumer upon a fair and equitable profit to the distributing agency whatever it may be."

Action by the Industry—"The commission realizes that the largest opportunity and the largest responsibility for putting the coal industry in order lies with the industry itself. The coal industry reveals . . . two distinct and contrasting tendencies in management. There is one that is animated by a purely inquisitive and exploiting spirit that has no other apparen end in view than to make money for the owners. Quick to make most of any panic among buyers, of any opportunit, to pyramid sales, to sell adulterated coal or to cut the wages of miners. This type of operator and dealer resents public interference or public knowledge of his business. He is rightly called a profiteer. . . . But besides profiteering there is also in the coal industry . . . a less conspicuous but equally unjustifiable element in the cost to the consumer." It is "a substantial part of the amount paid in royalties and in excess profits to owners of wealth who perform therefore no useful social service and who take no part in production. . . . There is no way in which this first deduction from the value of the product can be forcibly prevented, as far as the commission is aware, except through government ownership, which we believe to be both undesirable and impracticable, or by taxation on the excess profits and royalties, which we recommend."

The second class of operators and owners are those that are commencing "to realize their duty as citizens and who by their enlightened self-interest are establishing a spirit of co-operation that will promote the prosperity of the industry. They aim to pay fair wages.

to remove the cause for the sullen hostility which prevails to an astonishing extent among workers . . . to make mining a safer occupation even if this means lowering down production, to sell at a reasonable price that will bring a fair return to the investors with steady operation of the mines, to establish a reputation for clean and well prepared fuel, to standardize fair practices in contracts between sellers and buyers, to lay out and develop the mines in such a way as to conserve and economize the coal and to bring it to the market at the least expense, and to come through clean as an industry capable of solving its own problems, with a minimum of governmental supervision—all this is already clearly in the minds of many operators, miners, and dealers." The commission has greater confidence in such internal organization and such educational work as will promote these remedies than in any which is within the power of the Congress or legislatures to apply.

Opportunity for co-operative effort is in bettering conditions outside of the mines by providing better sanitary arrangements, by better roads and streets and schools, by improvements in the food supply, and in the facilities for healthy outdoor recreation. In their labor relations, common interest should lead both operators and miners to study the problem of unemployment and to seek to stabilize the industry. Joint committees should study the whole rate structure and its relation to the different jobs in the mines, perfect the machinery for settling disputes through conciliation or voluntary arbitration, and in the non-union field see that adequate check is kept on the right of discharge. "The operators need more effective organizations for labor relations and we recommend district and national labor commissioners, men of the highest type, who can work out a national labor policy. If the Sherman Anti-Trust law prevents the operators from combining together for the purpose of collective bargaining with the miners, which the commission does not believe is the case, then Congress should exempt them from the operation of the law for that purpose.

Discussion of Checkoff

"There are valid objections to the checkoff, especially in the collection of fines and assessments, and it has also injurious effects upon the union in divorcing the problem of income from the winning of membership, and in the resulting lack of closeness of contact and of educational service and control by the higher officers to the lower officers, and to the rank-and-file members of the unions; yet the checkoff is not vital enough to justify a suspension of operations, whether the union is seeking to extend its use or the operator seeking to throw it out.

"The history of the past 30 years affords conclusive evidence that the United Mine Workers of America has been the potent agency in the betterment of the miners' working and living conditions, and it is necessary today for the protection of standards that have been obtained. However, unless the union accepts in practice the principle that the public interest is superior to that of any monopolistic group, whether employers or employees, and gives satisfactory guarantees of a fair and orderly adjustment of controversies in other ways than by the exercise of economic force, the public will not view with sympathy the efforts of the union to extend itself over the whole field of the industry."

Action by the Consumer—The commission believes that part of the cure for the existing bad conditions is in the hands of the consumer, and that much can be done by preventing peak demands through systematic storage of coal along the lines indicated by the Federated Engineering Societies. It also believes that a further remedy lies in the purchase of coal by contracts which are more than mere options, and in the proper use of coal through careful studies as to the best grade of coal to suit the needs of both large and small consumers.

An executive order of the President has been issued which transfers the records and property of the commission to the Department of the Interior, and designates the Director of the Geological Survey to perform the administration duties incident to closing the work of the commission.

U. S. Sells Gorgas Steam Plant to Alabama Power Company

Secretary of War Weeks on Sept. 24 sold the Gorgas steam power plant on the Warrior River to the Alabama Power Co. for $3,472,487.25. This plant was built during the war by the government on land belonging to the power company, with a contract provision that the company could purchase it at a fair valuation. It was built as an addition to the Muscle Shoals plant to which it was connected by a transmission line. The total cost to the government was $4,750,000. Much interest has been attached to the plant because Henry Ford in his offer for the Muscle Shoals development has contended that he must have the Gorgas plant to make the development complete.

Drinker Becomes Chief Engineer of New York Port Authority

The chairman of the Port of New York Authority has announced the promotion of William W. Drinker to be chief engineer to fill the vacancy created by the death of B. F. Cresson, Jr., last January. Mr. Drinker began active engineering work as a resident engineer and inspector on the Lackawanna R.R., 1893-1898. From 1898 to 1900 he was construction engineer for the Delaware & Hudson Company's coal department. In 1900 he returned to the Lackawanna R.R. as an assistant engineer on yard and terminal work. In 1902 he went to the Erie R.R. as an assistant engineer on yard and harbor terminal work, which position he held until he was made assistant chief engineer of the same road in 1913. When the New York-New Jersey Port and Harbor Development Commission was created in 1918 he was made terminal engineer, remaining with that commission until its work was taken over by the present port authority in 1921. Since that date he has been terminal engineer and latterly acting chief engineer of the port authority.

Rigid Structures Survive Japan's Earthquake

(Concluded from p. 527)

In Tokyo

The Imperial Hotel of reinforced concrete and fireproof construction withstood both the quake and the fire and stands in good condition structurally.

The Marunouchi Building, of steel-frame and brick construction eight stories high, stood well with the loss of a few bricks. The Mitsukoshi Building, six stories, carrying a tower of three stories, of reinforced concrete, stood well with the possible and doubtful exception of one story, as reported by a very excited Japanese woman who was in the building at the time. The Marut Building of reinforced concrete is reported standing but cracked.

The Shimbashi Railway Station, with steel skeleton and brick walls, is intact.

The Nuzin Building of reinforced concrete and steel is reported standing but probably cracked.

The three story Healing Building of wood and brick was entirely wrecked while a reinforced-concrete building across the street was not damaged. A one-story wooden building next to this reinforced-concrete building was not damaged, so the fact that a building in Tokyo was not damaged is not necessarily any indication of earthquake-resisting qualities but the fact that the only buildings to stand in Yokohama were of steel or reinforced concrete is conducive proof that these materials are the best in use today for such emergencies and that they have excellent quake-resisting qualities.

Two reinforced-concrete bridges about 100 ft. in length of three spans each at Saguragicho withstood the quake. Many steel girder bridges of one span between Tokyo and Yokohama were shaken from their foundations and dropped into the river, always without failure of the steel. Many very heavily constructed wooden temples were totally demolished.

Railroad tracks were shifted from side to side several feet in waves of perhaps 300-ft. lengths.

The water system in Yokohama was destroyed by the first shocks causing geysers a foot in diameter, in places. The water system in Tokyo, while damaged, was still available for fighting fires.

Japan has no extensive municipal sewerage systems.

The electric wires in Yokohama were completely thrown to the ground, electrocuting great numbers of people.

Earth Cracks Open

When asked as to the depth of the earthquake crevasses, the engineer could not say as he did not take time to examine but rather ran and jumped as occasion required to escape. In places, he said, he saw the earth on one side of a crack move in one direction while the earth on the other side moved in the opposite direction parallel to the other movement and to the fissure.

Seismograph records indicate a maximum movement of the earth of about 3 in. vertically and 7 in. horizontally. Such records have little value in view of actual photographs showing uplifts and depressions of many feet—5 ft. certainly, perhaps 10—and horizontal movements of 2 to 4 ft. or more.

American Construction Council Has Annual Meeting

At its annual meeting in New York City on Sept. 21 the American Construction Council paved the way for an increased activity in the coming year on certain subjects which have been selected as outstanding in the building industry. Work is to be carried on under the direction of new committees, which are now in process of selection. The problems, as stated by the Executive Committee ofthe council are as follows:

"The promotion of and co-operation with local building congresses, a national survey of apprenticeship needs and conditions of labor supply, promotion of the stability of employment and reduction of unemployment, comprehensive steps toward the determination of the causes and the elimination of waste in all its phases throughout the industry, a general educational program as to the problems of the industry and its development, and the promotion of the concept of construction activities as a great American industry." The public meetings were confined to general discussion of these problems.

Three resolutions were adopted. In the first it was stated that while the collection and distribution of statistics to serve as a barometer of building were most necessary, the council will defer action toward such an effort. The second resolution favors co-operation of all members of the council with all the agencies now promoting apprentice training, and the third authorizes such sums as may be available up to $25,000 "to be used in the promotion of building congresses in various centers."

D. Knickerbacker Boyd, of Philadelphia, has been made executive vice-president of the council and Dwight L. Hoopingarner, executive secretary, with offices at 28 West 44th St., New York City.

Contract Awarded for Delaware River Bridge Cables

At a meeting of the Delaware River Bridge Joint Commission on Sept. 22, award of Delaware River Bridge Contract No. 8, for construction of the two main cables, was made to the Keystone State Construction Co. of Philadelphia. The award was made upon the basis of bids opened Sept. 19, as follows:

Item	Classification	Estimated Quantities for Comparison	Keystone State Construction Co. Unit Price	Keystone State Construction Co. Amount	Fred'k Snare Corp' New York Unit Price	Fred'k Snare Corp' New York Amount
1	Wire cables	13,500,000 lb.	$0.18	$2,430,000	$0.184	$2,484,000
2	Suspender ropes	50,000 ft.	1.60	80,000	1.90	95,000
3	Steel castings	180,000 lb.	0.15	27,000	0.20	36,000
4	High tensile bolts	6,000 lb.	0.15	900	0.20	1,200
5	Structural-steel shims	30,000 lb.	0.20	6,000	0.12	3,600
6	Cast-iron separators	30,000 lb.	0.10	3,000	0.15	4,500
	Total bid			$2,546,900		$2,624,300

These are the second bids submitted for the construction of the cables, the first opening having been held on Aug. 15, 1923, and bids rejected because they were in excess of the funds available for the work, as noted in *Engineering News-Record* of Aug. 23, p. 322. This contract is the fourth Delaware River bridge contract secured by the Keystone State Company. They constructed the main piers under Contract 2, and they are building the two anchorages, Contracts 4 and 5. The work under Contract 8 will require in the neighborhood of 18 months.

Officials Deprecate Report That Birdseye Party Is Lost

Publication in the daily press of a sensational article suggesting that C. H. Birdseye, the chief topographer of the United States Geological Survey, and his party have been lost while engaged in a survey of the Colorado River, is deprecated by the Director of that Bureau. The article apparently is based entirely on the discovery of wreckage of a Survey boat. Survey officials are confident that this is the boat lost recently by the Water Resources branch, when it was carried from its moorings by high water. Col. Birdseye and the members of his party are thoroughly familiar with the vagaries of the Colorado River and there is no evidence that they have been in any danger.

Kansas Society Starts a "Journal"

The monthly news-letter which the Kansas Engineering Society has been publishing for the past few months is now styled the "Kansas Engineering Journal" and its August number appeared under the new name. It is a 16-page publication 9 x 11½ in., with local news and some of the papers read at the annual convention of 1922. The journal, which supersedes the former annual volume of "Proceedings," is published at Wichita, Kan., under the direction of P. L. Brockway, president, and C. V. Waddington, secretary, of the Kansas Engineering Society.

Contract Awarded for Driving Moffat Tunnel

On Sept. 18 the Moffat Tunnel Commission entered into a contract with Hitchcock & Tinkler, of New York and San Francisco, to construct the Moffat tunnel on the line of the Denver and Salt Lake R.R. The contract price for doing the work is $5,250,000, and the contractors are to do the work for a fixed fee of $140,000.

The contract stipulates that the work shall be completed in 46 months, that should the cost be less the saving shall be equally divided between contractors and commission, that should the 46-month limit be exceeded the contractors shall be penalized $1,000 per day and that should the work be done in less time than is stipulated, the contractors shall receive a bonus of the same amount.

Hitchcock & Tinkler are well known in the west for tunnel work, that firm having but recently completed the 18-mile Hetch-Hetchy tunnel for San Francisco's water supply. The firm also built 16 miles of the Denver and Salt Lake road, including 15 tunnels, and some 500 miles of railroad in the Southwest for the El Paso and Southwestern Ry.

Arizona Presents State Plan To Develop Colorado Power

Washington Correspondence

A plan for the development of the power resources in the Arizona sector of the Colorado River by the state was laid before the Federal Power Commission Monday. Arizona was represented by Governor Hunt and a committee of nine. State Senator Elliott, acting as spokesman for the committee, denounced the Colorado River compact as unfair to Arizona. He said Arizona was asked to agree but got nothing in return. He intimated that federal officials had attempted to coerce Arizona into signing. Arizona is not objecting to granting the Girand license and the development of the power at Diamond Creek by the copper companies, it was explained. The state feels that it will be able to take over those developments when it is prepared to proceed with its comprehensive development of the river's power resources. The upstream states are scheduled to reply to the Arizona contention at an early date.

Railway Roadmasters Hold Meeting at Chicago

Few and short reports, active discussions and a large attendance marked the forty-first annual convention of the Roadmasters and Maintenance-of-Way Association, held at Chicago on Sept. 18 to 20.

In a report on "Track Maintenance in Large Yards," R. W. E. Bowler, division engineer, Pennsylvania R.R., pointed out that with modern heavy cars and heavy switch engines it is not economical to use light or worn rails or to neglect maintenance work. Somewhat the same view was taken by W. F. Muff, roadmaster, A., T. & S. F. Ry., in a report on "Maintenance of Branch Lines." Although traffic may be light as far as number of trains is concerned, the weight of cars is likely to be much the same as on main lines, and even heavy engines may be operated. He considered second-hand 80-lb. rail from main track to be advisable, rather than the 56- to 60-lb. rails sometimes used.

Labor saving devices were reported upon by A. M. Clough, roadmaster, New York Central R.R., who referred to the increased weight of modern track material. Cranes and hoists for handling material, ditchers, ballast cleaners and track shifters represent the larger class of machinery, while for ordinary track work there are numerous electric and pneumatic tools for tamping, drilling, sawing and similar operations. Methods of tie inspection, treatment, distribution and renewal on the Atchison, Topeka & Santa Fe Ry. were reviewed by S. D. Cooper, assistant manager of treating plants, who showed that under these methods the number of ties renewed per mile has been reduced from 336 in 1898 to 158 in 1922. Maintenance of rail joints was the subject of a paper by R. S. Cochran, assistant engineer, A., T. & S. F. Ry.

The new president is J. B. Martin, New York Central R.R.; vice-presidents, W. F. Muff, Santa Fe Ry., and G. W. Morrow, New York, New Haven & Hartford R.R.; and Secretary J. P. McAndrews, C. & N. W. Ry., Sterling Ill. The 1924 convention will be held in New York.

Engineering Societies

Calendar

Annual Meetings

INTERNATIONAL ASSOCIATION OF STREET SANITATION OFFICIALS, Chicago, Ill.; Annual Conference, Chicago, Sept. 27-28, 1923.

AMERICAN PUBLIC HEALTH ASSOCIATION, New York; Annual Meeting, Boston, Oct. 8-11.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York; Fall Meeting, Richmond, Va., Oct. 17-20.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, St. Petersburg, Fla.; Annual Convention, Atlanta, Ga., Nov. 12-16.

CITY MANAGERS ASSOCIATION, Lawrence, Kansas; Annual Meeting, Washington, D. C., Nov. 13-15.

The Boston Society of Civil Engineers Sept. 19 considered the subject: "Apprenticeship in the Boston Building Trades," with discussion of the recently-adopted system for the enrollment of apprentices by several of the building trades: by William S. Parker on the situation leading up to the system; Major H. S. French, speaking from the employer's standpoint; and James M. Gauld and George Thornton representing the views of the trade unions and employees.

The Colorado Section, American Society of Civil Engineers, were hosts at a banquet given Sept. 13 to Charles F. Loweth, chief engineer of the Chicago, Milwaukee & St. Paul R.R., and president of the Society. More than 100 members of the society were present, the principal speaker being Mr. Loweth. Other out-of-town engineers present were: Leonard Metcalf, of Metcalf and Eddy, Boston; and J. Vipond Davies, and J. Waldo Smith, of New York, and Chief Engineer Keays of the Moffat Tunnel Commission. John S. Means, president of the Colorado Section, presided.

The Engineering Society of Western Massachusetts held its monthly meeting Sept. 25 at the new power development of the New England Power Co. at Whitingham, Vt., the motor trip starting from Springfield, Mass.

The New York Section of the American Water Works Association will hold its annual meeting Oct. 6 at Watertown, N. Y. Charles R. Bettes is president and Burt B. Hodgman is secretary of the section.

Personal Notes

LEWIS B. SMITH, Rochester, N. Y., has been appointed assistant office engineer of the municipal engineering department of Rochester. Mr. Smith has been in this department since 1919, at which time he was transferred from the water-works bureau. He at one time superintended the construction of the conduit line from Rush to Rochester.

PROF. A. DIEFENDORF has assumed his new duties as assistant professor of civil engineering at Rose Polytechnic Institute, Terre Haute, Ind. The past two years Prof. Diefendorf has taught in the University of Illinois. He is a graduate of Ohio Northern University.

DANIEL B. LUTEN, of Indianapolis, Ind., president of the Luten Engineering Co., has been appointed a member of the Indiana state board for the registration and examination of engineers and land surveyors, succeeding R. L. MCCORMICK, of Terre Haute.

HENRY RIEGER, for several years assistant city engineer of Phoenix, Ariz., has been appointed city engineer of that city.

JOSEPH H. STEPHENS, president of the Merchants National Bank of Sacramento, has been appointed a member of the California State Reclamation Board, succeeding PETER R. GADD, who recently resigned.

CHARLES F. ABBOTT has been selected by the American Institute of Steel Construction to assist LEE H. MILLER, who was made managing director of the organization last January, in the technical work of the institute, which centers around the adoption of a standard specification. Mr. Miller will continue his work of direction from the Cleveland office, as chief engineer of the organization, and Mr. Abbott will direct the affairs of the institute from an office soon to be located in New York City.

GEORGE LAMPING, Seattle, Wash., was elected president of the Pacific Coast Association of Port Authorities at its annual convention at Seaside, Ore., last week.

WILLIAM H. CARTER, commissioner of public wroks at Santa Monica, Calif., for the past twelve years, has resigned his unexpired term to accept the position of business manager of the Pacific Palisade Association.

H. E. SPRY, formerly construction engineer with the Genesee Construction Co., Rochester, N. Y., has joined the organization of the Mamer Co. for work in designing and estimating, and is located at Benton Harbor, Mich.

R. L. HOCKETT has been appointed an assistant engineer for the Kansas State Highway Commission, located at Topeka, Kan. He had been supervising plans and surveys for Division 2 of the Missouri State Highway Commission.

JOHN SMALLSHAW, recently made general superintendent of construction for the Smallman-Brice Construction Co., Birmingham, Ala., formerly was superintendent of construction for the Carolina Construction Co.

A. T. FULKERSON is resident engineer on city paving and sewer construction at Newport, Ark., for the Morgan Engineering Co. of Memphis, Tenn. Mr. Fulkerson's previous work was as civil engineer for the Henry W. Horst Co., Rock Island, Ill.

WALTER P. BLOECHER is now engineer in the structural division of Stone & Webster, Inc., in Boston, Mass. He was formerly with Charles T. Main, engineer, and in 1922 joined the Stone & Webster organization in its New York office.

CALVIN CAMPBELL, who is now located at Alamosa, Colo., as superintendent on the construction of railroad shops for Battey & Kipp, Inc., was formerly superintendent of the water-works and assistant city engineer of Cheyenne, Wyo.

DAVID L. YARNELL, since 1916 senior drainage engineer in the U. S. Bureau of Public Roads, in co-operation with the State University of Iowa is conducting hydraulic research investigations on road culverts, at the university hydraulic laboratory. Mr. Yarnell is a graduate of Iowa State College, has conducted special investigations for the Bureau of Public Roads in reclamation of swamp lands and in hydraulic research, and is the author of many reports of the Bureau on these phases of its work.

F. LAVIS, consulting engineer, New York City, sailed Sept. 19 for Bogota, Colombia, to make an examination of certain railroad projects there which the Colombian government has under consideration.

C. MCN. STEEVES has been appointed construction engineer of the New Brunswick Hydro Commission, under the direction of the acting chief engineer, S. R. Weston. Captain Steeves has two degrees in civil engineering from the University of New Brunswick. Since 1906 he has been engaged successively as assistant engineer of the Federal Department of Public Works at St. John, N. B., chief engineer of the Maritime Dredging Co. in dredging work at St. John, in service in France with the Canadian Engineers, and contractor's engineer on the international bridge between Edmunston, N. B., and Madawaska, Me.

Obituary

LOGAN PHILLIPS, a junior engineer attached to the U. S. District Engineer's office in New York City, was instantly killed last week when an iron bracket became dislodged from the cornice of a six story building at 171 Broadway, and fell, hitting Mr. Phillips upon the head. Mr. Phillips had just left the army engineer headquarters after a conference with Col. J. R. Slattery, regarding the dredging of East Chester Creek, work which was to be under Mr. Phillips' direction.

WILLIAM HENRY MERRILL, founder and president of the Underwriters' Laboratories, Inc., died Sept. 16 in Chicago at the age of 55 years. He was graduated from Massachusetts Institute of Technology in 1898 and has been in fire prevention and fire protection work ever since. The work of the laboratories was organized in 1898 by Mr. Merrill. He was a past-president of the National Fire Protection Association.

BENJAMIN T. FENDALL, formerly city engineer of Baltimore and since 1912 secretary of the Maryland Public Service Commission, died Sept. 18 at his home in Baltimore, aged 72 years. He was a native of Virginia and as a young man was connected with the engineering department of the Baltimore & Ohio R.R.

From the Manufacturer's Point of View

A Point of Contact
Between Maker and User of
Construction Equipment and Materials

Japan Faces Gigantic Rebuilding Program

Need for American Lumber and Piling Seen in Reconstruction of Half Million Edifices Razed by Earthquake

HOUSING operations as America knows them even in war times, appear insignificant beside the scope of the building operations Japan now faces in reconstructing the great cities of Tokyo and Yokohama, according to Far Eastern Division of the Department of Commerce. The latest reports place the destruction of buildings in the earthquake-devastated areas at 316,000 in Tokyo, or about 71 per cent of the total number in that city, while in Yokohama, out of the 85,000 buildings standing before the disaster of Sept. 1 only 15,000 are left intact. The destruction in the outlying districts may bring the total of buildings destroyed up to the half-million mark, the large majority of which are homes. This number, added to the housing shortage that existed in Japan before the earthquake, will necessitate the construction of dwelling houses on a large scale. Since Japan normally looks to the United States for about 60 per cent of its lumber requirements it is expected that the demand for American lumber during the reconstruction period will be very heavy.

Prices and Deliveries

The price of Japanese lumber delivered c.i.f. Yokohama or Tokyo has been approximately 20 per cent higher than that of similar qualities of American lumber, and American freight rates have been favorable. The American market also finds itself in a favorable position as regards delivery. It often happens that the Japanese importer can secure delivery from Pacific ports to Yokohama in less time than from Hokkaido, Karafuto, or even from the northern provinces of Japan proper. Japan's preference for American lumber, aside from the price consideration, is due to the fact that our lumber is more nearly like that of Japan proper than the product of any other country from which it draws wood supplies. This similarity of wood makes it possible for Japanese builders to substitute American lumber for Japanese in all building projects. In fact, its use has become so universal that American lumber is now specified in many instances.

Kind of Lumber Imported

The principal lumber imports of Japan consist of fir, hemlock, pine and cedar, about half of which is imported in large squares of from 12 to 24 in. and a lesser amount in small squares of 4½ by 4½ in. The large squares are worked up in the local mills and carpenter shops into the different shapes required for general building, while the smaller squares are used as studs for holding up roofs and for supporting beams. The large squares are very popular among builders in Japan and can only be obtained from America.

The only competition confronting the United States in trade in this class of lumber, according to the Department of Commerce, will come from other parts of North America, as the Siberian, Manchurian, Hokkaido, and Saghalien or Karafuto pines and cedars are all of inferior quality and accepted only as substitutes for Japanese and American woods. At the time of the disaster stocks of lumber in Japan were quite large, especially in Kobe, Osaka, and Tokyo. Assuming that all the stocks in Yokohama and Tokyo were destroyed, it is seen that there is still a fairly good supply on hand for immediate emergency purposes. The real demand will come when the permanent construction of the devastated areas commences. The requirements for home building will no doubt be satisfied first and will take the largest share of the lumber imports.

In comparison with our own homes little wood is required for the construction of Japanese dwellings, in which paper, straw, matting and tile (for roofing) play a large part, but during recent years the tendency has been toward a greater use of wood, especially for ceilings and interiors, as the Japanese are very fond of polished wood in its natural colors. In this respect our lumber has lent itself very admirably owing to its superior quality.

Piling will be required in large numbers, the Department of Commerce states, for reconstructing the destroyed docks and waterside warehouses and sheds in Yokohama and Tokyo, as well as for building subfoundations for industrial buildings, bridges, and construction work in general. The city of Tokyo for some time has contemplated the widening and straightening of its narrow, crooked streets, and many have already been designated for this improvement. This plan will no doubt be carried out in the reconstruction program and the widening of the streets will require enormous quantities of paving blocks. Douglas fir has been used in Tokyo's paving program.

New Tractor Service Schools Are Announced

That the tractor public including owners, operators and others interested may possess more fundamental knowledge regarding caterpillar tractors an extensive educational program is under way, under the auspices of the Holt Manufacturing Co. of Peoria, Ill. and Stockton, Calif.

The "Caterpillar Service School of the North," the first of a series, was held in Wausau, Wis., Aug. 13 to 21, inclusive. Northern distributors for the caterpillars including the E. A. Drott Tractor Co., of Wausau; Lange-Nash Motor and Tractor Co., of Duluth; and the Upper Peninsula Tractor Co., of L'Anse, Mich., co-operated with the Holt company in the conduct of the school.

The school was attended, not only by tractor operators and mechanics, but also by county highway commissioners, superintendents and other officials of various lumber companies throughout that territory. The Wausau school is the forerunner of others to be held this winter at Boston, Richmond, Dallas, Atlanta, Memphis, Minneapolis, Omaha and Peoria.

The operation, adjustment and lubrication of all models of caterpillar tractors were thoroughly explained. Each model was sub-divided into various assemblies, each of which in turn was described in an illustrated lecture following which the students, under the supervision of competent instructors, would totally disassemble these various assemblies and re-assemble them.

The tractor service schools are being conducted by H. H. "Jack" Chambers, director of service for the Holt Manufacturing Co. He is assisted by Herbert S. Hinrichs, Earl J. Howey, Jack Westphal and George W. Rhodes, all men of long years of tractor experience.

Road Show Exhibit Applications Close Oct. 27

Applications for exhibit space at the Good Roads Show to be held in the Coliseum, Chicago, Jan. 14-19, 1924, during the annual convention of the American Road Builders' Association, must be filed at the office of the association, 37 West 39th St., New York, N. Y., on or before Oct. 27. The allotment of space will be made the following week by members of the association's executive committee and the Highway Industries Exhibitors' Association. Demands for space are expected to exceed the amount available. Exhibitors are advised to limit their displays to their latest and most important products.

To fill vacancies on the board of directors of the exhibitors' association created by the resignation of John B. Hittell, C. N. Leet and H. R. Snow the following were elected at a meeting in Chicago Sept. 7: George W. Craig, district engineer, Asphalt Association, Chicago; Lion Gardiner, sales manager, Lakewood Engineering Co., Cleveland; and C. E. Bement, vice-president and general manager, Novo Engine Co., Lansing, Mich.

Construction Equipment Exported

The following exports of American construction equipment were made during July, according to figures collected by the U. S. Department of Commerce:

Seventy-two concrete mixers valued at $55,041; miscellaneous road making and construction equipment, 890,678 lb., valued at $150,407; 38 conveyors at $23,085; 14 power shovels at $71,186; 715,944 lb. of dredging machinery at $45,833; 18 cranes at $88,562; 556 hoists and derricks at $103,438; 13 water wheels and turbines (under 300 hp.) at $9,048.

Shipments of roofing material were valued at $96,341 for asphalt roofing, $57,769 for asbestos roofing, and $54,716 for other types of roofing.

Japan was the largest consumer of concrete mixers during July, with 30 valued at $23,549. One power shovel at $22,300 was shipped to Honduras and 7 power shovels at $17,705 to Japan. Roumania bought one shovel at $9,000.

Paving Contractors Endorse 13-E Mixer

A. G. C. Vote of 2 to 1 Endorses Utility of 3-Sack Capacity for Medium-Sized Machine — Reasons for Preference Stated

BY A VOTE of 2 to 1, the 13-E or 3-sack paving mixer has been designated by paving companies of the Associated General Contractors as the proper size of machine to supply the requirements of a middle-sized paver. On account of a difference of opinion among manufacturers expressed at the meeting of the Joint Committee on Construction Equipment, in Chicago, July 30, this matter was referred to the Associated General Contractors for determination by referendum to members interested in paving work. Certain manufacturers favored the 12-E or 2-sack machine, while certain others favored the 3-sack type.

The opinion of paving companies concerning this matter is indicated by the replies received to the following questions:

(1) Exclusive of type consideration, which size of paver is preferable for work requiring a medium-sized machine? Result: 94 in favor of the 3-sack and 49 in favor of the 2-sack.

(2) If the 3-sack machine sells at a price of $1,500, or less, above the 2-bag, would the price be the determining factor to any great number of construction companies? Result: 49 Yes, and 93 No.

(3) If the 3-sack machine is in your judgment more suitable, should the advantage of capacity be sacrificed to the production of a machine at a relatively lower price? Result: 43 Yes, 96 No.

(4) Is it advisable to have a paver between the 7-E and 21-E? Result: 94 Yes, 49 No.

Reasons for Preference

Reasons assigned for voting in favor of the 3-sack machine are as follows:

Samuel Gamble Co., Carnegie, Pa.—"As the paver in question would be used on city streets, car lines, alleys, and other limited paving jobs where material would be handled almost entirely by hand, we believe that the 3-sack mixer would be preferred by the majority of road and street contractors. It would also be the most practical size for retaining walls, culverts, small bridges usually found in connection with road and street work. The question of price we believe in the past has been too large a factor and if the equipment manufacturers will concentrate on a limited number of sizes, high quality, one hundred per cent service, and sell the machine best required to perform the work which the contractor has to do, the question of price will take care of itself."

Winston & Co., New York — "The specifications of a number of state highway departments now provide that no mixer of less than 3 bag capacity can be used in the laying of concrete surface. It is our opinion that the 3 bag paver will meet the requirements for a small-sized unit on city streets cut by car lines, alleys, etc., and at the same time give the contractor a unit of greater changeability and marketability than the 2-sack paver. This is due to the fact that it will also be suitable for use on highway paving work in emergency, or under particular circumstances which might make a temporary use for such purposes desirable."

Bent Bros., Los Angeles, Calif.—"We like the large paver because it is not likely to be overworked as much as the smaller one. The vital parts will stand up better under the requirements. This condition does not, however, develop while the machines are new."

As the referendum on the middle-sized paver was sent to all members of the Executive and Advisory Boards and Presidents' Council of the Associated General Contractors, a number of ballots were received from contractors not engaged in paving work. Upon request of the manufacturers ballots from those not so engaged were not included in the tabulation of results unless it was specifically stated that they had consulted paving companies and ascertained their opinion. Most of the companies not engaged in paving work did not submit their vote on the grounds that they believed the matter should be determined on a vote of paving companies only.

Next Week

An article discussing some of the problems involved in selling building materials will offer to the purchasers of supplies—contractors, engineers and architects—the point of view of a manufacturer. An understanding of the practices of both maker and user of equipment and materials should be mutually helpful—

Editor

Track Exhibits at Roadmasters' Convention, Chicago

Exhibits of railway track material and appliances at the Chicago convention of the Roadmasters and Maintenance-of-Way Association, Sept. 18 to 20, were numerous and varied but included few novelties. Labor-saving devices were not much in evidence, in spite of the marked development along this line in railway maintenance work.

Various makes of motor section cars were exhibited. Nearly all railways now recognize the advantages of these cars as compared with hand cars. Ballast-tamping machines included the Jackson electric tamper of the Electric Tamper & Equipment Co., Chicago, and the pneumatic tamper of the Ingersoll-Rand Co., New York. Ditching cranes, spreader cars and weed-killing cars were represented by views and moving-pictures, since the exhibits were arranged on a hotel balcony and there was no opportunity to place large machinery.

One novel device was the Mack switch protector, by J. R. Fleming & Sons Co., Scranton, Pa. This consists of a tapered block bolted inside the rail just ahead of the switch, so that wheels with flanges hugging the rail head are prevented from striking the switch point.

A large part of the exhibit consisted of hand tools and the smaller class of track material, such as tie-plates, nutlocks, bolts and rail anchors, together with some derails, switch and frog details and wire fencing. There were also torches for clearing ice and snow from switches. The exhibit, arranged by the Track Supply Association, comprised about sixty exhibitors.

Business Notes

E. L. SPARKS, for the past five years New England sales manager for the Erie Steam Shovel Co., with headquarters in Boston, has resigned to open an advertising service agency in New York next month, specializing in machinery and building material accounts. He served for 4 years as copywriter in the advertising service department of the McGraw-Hill Co., Inc., and the McGraw Publishing Co., and prior to that was engineer in charge of various construction projects.

TRUSCON STEEL CO., Detroit, announces that after Oct. 1 its Michigan office will be located in the company's new building at 615 Wayne St., Detroit, occupying the entire second floor. The office includes a service organization and engineering department, equipped to furnish information, estimates and details on all the company's products, including reinforcing steel, metal laths, steel windows and joists, highway reinforcements, standard buildings, inserts and pressed steel parts

LINK-BELT CO., Chicago, which for some years has maintained sales and distributing offices in San Francisco, Los Angeles, Portland and Seattle, has just acquired the business and manufacturing facilities of the Meese & Gottfried Co., which for many years has manufactured transmission and conveying machinery on the Pacific Coast. It is the intent of the new owners to increase facilities, enlarge stocks and improve methods of distribution so that the demands of customers can be met promptly and completely.

JOE GLOZIER, Birmingham Slag Co., with offices in the Walton Building, Atlanta, Ga., has been appointed chairman of the Exhibit Committee which will have charge of the display of equipment and materials at the annual convention in Atlanta, Nov. 12-16, of the American Society for Municipal Improvements. Convention headquarters and the exhibit will be at the Ansley Hotel.

BURTON-TOWNSEND CO., Zanesville, Ohio, manufacturer of paving block and building brick, announces the appointment of Arthur M. Crumrine and Samuel A. Kinnear as receivers for the company. Creditors are requested to file proof of claims against the firm with statement of account in detail.

ALBERT S. BOISFONTAINE, who has been assistant to the manager of the Southern Pine Association since last June, has been appointed assistant secretary. He has been with the association, serving in a number of capacities, since 1917.

VALLEY ROLLING MILLS, INC., Elmira, N. Y., recently incorporated under the laws of the State of New York to take over a complete merchant bar and light structural shape mill originally built by the Quirke interests, will begin rolling at once. Marcel K. Sessler of New York enters the organization as vice-president and treasurer, and will b actively associated on the business side, with E. F. Quirke and J. S. Quirke, who are experienced and practical mill

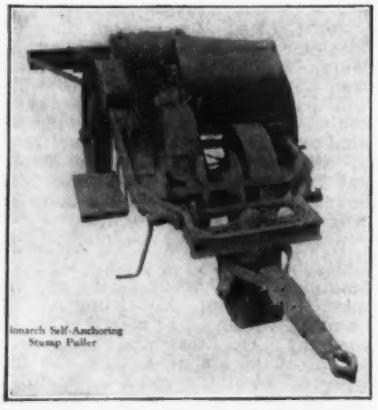
men and will be in charge of the production end of the business. The general negotiations and this consolidation were effected through the Engineering Business Exchange, New York, of which Charles Whiting Baker, formerly editor of *Engineering News-Record*, is director.

Equipment and Materials

Self-Anchoring Stump Puller

A machine for pulling stumps, with a self-anchoring device which makes it unnecessary to tie the equipment to other trees or stumps, has been developed by Monarch Tractors, Inc., Watertown, Wis. The puller is mounted on a three-wheel chassis with a small diameter castor wheel at the front end which permits short turns. Through the two rear wheels passes a large diameter axle which supports a heavy pivoted steel channel frame, the rear end of which carries the anchoring device consisting of a sharp blade. This anchoring blade is forced into the ground as there develops a pull on the machine, holding the latter in place. To counter-balance the heaviest pulls weights in addition to that of the machine itself are hung from a boom held in position by guy wires attached to the frame. The boom serves also as a tongue when using horses to move the machine.

The power plant consists of a Ford motor driving a cable drum 12 in. in diameter and 10 in. wide, holding 50 ft. of cable. The motor is fitted with a special water circulating pump. The equipment weighs 5,000 lb., its length is 16 ft., width 6 ft., and height 4 ft. 3 in.



Monarch Self-Anchoring Stump Puller

With this machine a direct cable pull of 50,000 lb. is secured, or 100,000 lb. with a single block. Field experience by the manufacturer indicates that a crew of four men is required to keep the puller working to capacity. They are distributed as follows: One operator, two men handling cables; one man on tractor or team. It is asserted that half an acre of stump land may be cleared at one setting of the machine. The engine has two speeds forward and one reverse so that the slack in the cables can quickly be taken up with the high speed and the stump pulling operation performed in low gear. For pulling stumps not close to the machine several 50-ft. lengths of cable with open and closed rings are used.

Crawler Tractor Makes Another Long Journey

Another long-distance trip has been undertaken by the Monarch crawler tractor which last year completed a journey of 1,513 miles from Watertown, Wis., to New Orleans, starting Oct. 8 and finishing Dec. 11, 1922, a total traveling time of 399½ hr. The same tractor, on Aug. 24, started from the company's plant at Watertown on a 500-mile route to various state fairs in Wisconsin and Illinois and is scheduled to end its trip at Peoria, Sept. 28, where it will be on display at the National Implement and Vehicle Show.

The tractor is pulling a 5,000-lb. two-wheel trailer. On its trip from

Watertown to New Orleans the tractor made an average speed of 3.78 miles per hour and covered an average of 26.6 miles per day. Pulling the same trailer as is used on the trip now in progress, the tractor consumed an average of 3.4 qt. of gasoline per mile. The total gasoline consumption on the 1,513-mile trip was 1,290 gal. and the lubricating oil consumed was 30 gal.

Publications from the Construction Industry

Snow Plows—BAKER MANUFACTURING CO., Springfield, Ill., in a 16-p. illustrated catalog, explains the operation of its snow plows designed for mounting on the front end of a truck. The plows are built in two models, one with a straight blade and the other with a V-shaped blade. The straight blade is protected from damage in striking obstacles by the use of safety tipping blades in the form of hinged sections 2 ft. long held in place by compression springs, which allow the sections to tip backward when they strike such an obstruction as a manhole cover. The springs snap the safety blades back into position after the obstruction is passed. The plows are built in lengths of 8 and 10 ft.

Industrial Trucks—CRESCENT TRUCK CO., Lebanon, Pa., has just issued a catalog explaining the design and illustrating the uses of its electric industrial trucks and tractors for handling material in shops and factories, loading cargoes at docks, etc. The company's general utility truck is designed to carry a pay-load of 4,000 lb. in addition to hauling a trailer. A four-wheel steer insures maximum flexibility of operation, allowing the truck to run in narrow aisles, on small elevators, and around pillars and machines in congested factories. This truck operates at a speed of from 5 to 6 m.p.h. The truck is operated by a 21-cell storage battery and a 36-volt, 35-amp. motor. The truck may be fitted with a crane attachment for special purposes. The height of the loading platform above the floor is 23 in. For handling very heavy and combersome materials a low-platform truck has been designed, the platform of which is only 12¼ in. from the floor.

Filtration Equipment—PERMUTIT CO., New York, has issued a 23-p. illustrated pamphlet dealing with its vertical and horizontal inclosed steel-shell pressure filters and its open-top gravity filters of wood or concrete. The smaller sizes of pressure filter of the vertical type have shells from 16 to 24 in. in diameter, built for a working pressure of 100 lb. per square inch. For larger installations the horizontal type with steel shells of 8 ft. diameter and from 10½ to 25 ft. long are recommended. The text explains, in general terms, the various steps involved in the process of rapid sand filtration.

Water Sterilization—WALLACE & TIERNAN CO., INC., Newark, N. J., has issued two technical publications, each of four pages, on its chlorinators for medium-sized and small water supplies. The text explains the application of this equipment, taking up such matters as amount of chlorine required, pressure against which the chlorine can be applied and diffusion of chlorine in the water. Sketches show typical installations.

Drill Sharpeners—SULLIVAN MACHINERY CO. has just issued a new illustrated bulletin on drill sharpeners for hammer forging drill bits and shanks. These machines are operated by compressed air and the sharpening process is done by hammering, with the steel at relatively low temperatures. In connection with the use of the sharpener an oil furnace, insuring uniform temperatures, is recommended. The sharpeners are made in two sizes, A and B, weighing respectively 4,000 and 1,500 lb.

Clamshell Buckets—BLAW-KNOX CO., Pittsburgh, in a 35-p. illustrated pamphlet, features its single-line clamshell buckets, which utilize the same line for both closing the bucket and for supporting it during opening. A feature of the equipment is the elimination of locks, catches, or other sliding parts. The buckets are built in sizes from ½ to 3 cu.yd. capacity. The text features also the company's single rope cableway in which only one hoisting drum is required for both hoisting and transporting the load along the cable track.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Structural-Steel Sales

The Department of Commerce announces August sales of fabricated structural steel, based on figures received from the principal fabricators of the country. Total sales of 130,568 tons were reported for August by firms with a capacity of 224,305 tons per month.

Tonnage booked each month by 176 identical firms, with a capacity of 230,475 tons per month, is shown below, together with the per cent of shop capacity represented by these bookings. For comparative purposes, the figures are also prorated to obtain an estimated total for the United States on a capacity of 250,000 tons per month.

1922	Actual Tonnage Booked	Per Cent of Capacity	Computed Total Bookings
April	200,968	87	217,500
May	185,065	80	200,000
June	168,894	73	182,500
July	158,012	69	172,500
August	156,559	68	170,000
September	146,827	64	160,000
October	133,037	58	145,000
November	112,367	49	122,500
December	138,737	60	150,000
1923			
January	173,294	75	187,500
February	184,887	80	200,000
March	218,400	95	237,500
April	186,117	81	202,500
May	131,875	57	142,500
June	118,063*	51	127,500
July	116,774**	51	127,500
August	131,770***	56	140,000

* Reported by 174 firms with a capacity of 230,460 tons.
** Reported by 169 firms with a capacity of 229,815 tons.
*** Reported by 158 firms with a capacity of 224,305 tons.

Production of Brick

Regarding domestic production of brick during July the following comment is made by the Common Brick Manufacturers' Association: The brick shipped from plants in July was approximately the same as in the preceding month, and the production of brick showed a slight increase. Ninety-three firms reporting, representing practically every section of the country, show unfilled orders on the books amounting to 342,719,000, brick, which is a little more than 50,000,000 less than was recorded in the Aug. 1 report, which reflected conditions on July 1. This drop is not serious at this season of the year. There is nothing discouraging in the current reports from manufacturers, and out of 76 who indicated future outlook for business, 20 were found in the "good" column, 48 viewed the outlook as "fair" and only 8 say it is "bad." Among the firms reporting only one plant was shut down during the month of July, all others shut down being for less than the full month and that principally for repair. The decrease in unfilled orders is quite evenly distributed over all of the Eastern, Southern and Middle Western territory. In California there is shown an increase in orders on the books and a better condition is reflected in the other coast states and in the Southwest. No price change is recorded.

Wholesale Prices in August

Wholesale prices in August averaged slightly lower than in July according to information gathered in representative markets by the U. S. Department of Labor through the Bureau of Labor Statistics. The Bureau's index number, which includes 404 commodities or price series weighted in proportion to their relative importance, sank to 150 in August, a drop of 1 point from the figure of the month before.

The largest decrease from the preceding month is shown for the group of fuel and lighting materials, due to further declines in bituminous coal, crude petroleum, and gasoline. The decrease in this group was 2¾ per cent. Building materials and housefurnishing goods each declined 2 per cent from the July level.

In the group of farm products increases in corn, rye, wheat, cattle, hogs, eggs, hops, and hay brought the level of prices nearly 3 per cent higher than in July. Foods also averaged higher than in the preceding month. No change in the general price level was reported for cloths and clothing and for metals and metal products.

Of the 404 commodities or series of quotations for which comparable data for July and August were collected, decreases were shown in 137 instances and increases in 110 instances. In 157 instances no change in price was reported.

INDEX NUMBERS OF WHOLESALE PRICES BY GROUPS OF COMMODITIES

(1913 = 100)

Group	1922 August	1923 July	1923 August
Farm products	131	135	139
Foods	138	141	142
Cloths and clothing	181	193	193
Fuel and lighting	271	183	178
Metals and metal products	126	145	145
Building materials	172	190	186
Chemicals and drugs	122	128	127
House furnishing goods	173	187	183
Miscellaneous	115	121	120
All commodities	155	151	150

Comparing prices in August with those of a year ago, as measured by changes in the index numbers, it is seen that the general price level has declined 3¼ per cent. This is due entirely to the great decreases among fuel and lighting materials, which averaged 34¼ per cent less than in August, 1922, at which time a strike was in progress in the coal fields. In all other commodity group prices were higher than in August of last year, ranging from 3 per cent in the case of foods to 15 per cent in the case of metals and metal products.

Bookings of Steel Castings

The Department of Commerce announces August bookings of steel castings, based on reports from principal manufacturers. The bookings in August by companies representing over two-thirds of the commercial-castings capacity of the United States amounted to 50,515 tons, as against 52,066 tons in July. The following table shows the bookings of commercial steel castings for the past eight months by 65 identical companies, with a monthly capacity, of 96,900 tons, of which 38,300 tons are usually devoted to railway specialties and 58,600 tons to miscellaneous castings.

BOOKINGS OF COMMERCIAL STEEL CASTINGS

Month 1923	Total Net Tons	Total Per Cent of Capacity	Railway Specialties Net Tons	Railway Specialties Per Cent of Capacity	Miscellaneous Castings Net Tons	Miscellaneous Castings Per Cent of Capacity
January	100,605	103.8	47,879	125.0	52,726	90.0
February	90,152	93.0	39,845	104.0	50,307	85.8
March	143,564	148.2	76,409	199.5	67,155	114.6
April	90,968	93.9	39,610	103.4	51,358	87.6
May	89,493	92.4	38,788	101.3	50,705	86.5
June	84,878	87.6	42,773	111.7	42,105	71.9
July*	52,066	53.7	16,741	43.7	35,325	60.3
August	50,515	52.1	18,332	47.9	32,183	54.9

* Two companies with a capacity of 785 tons per month on miscellaneous castings now out of business.

Federal Reserve Statistics on Business Conditions

Production of basic commodities and employment at industrial establishments decreased in July and there was a further decline in wholesale prices, according to the monthly review of business and financial conditions by the Federal Reserve Board. The distribution of goods, as indicated by railroad freight shipments, maintained record totals and the sales of merchandise, though showing the usual seasonal decline to be relatively heavy.

Production in basic industries, according to the index of the Federal Reserve Board, declined 1 per cent in July. New building operations showed more than the usual seasonal decline.

Large Contracts Let During Week

Among the week's announcements of contracts awarded in Construction News, pp. 173 to 185, are the following:

Distributing Station, Middletown, Conn., to R. H. Beattie Constr. Co., Fall River, Mass., $1,000,000.

Store and Club, San Francisco, Calif., to R. McLeran Co., $1,000,000.

Home and Infirmary, Wende, N. Y., to H. Shenk, Erie, Pa., $1,079,000.

Grain Elevator, Oswego, N. Y. to James Stewart Co., New York City, $1,119,959.

Tunnel, Colorado, to Hitchcock & Tinkler, Denver, $6,075,000.

Cables, Philadelphia bridge, Keystone State Constr. Co., $2,546,900.

Bids Wanted on Big Jobs

Among the projects on which bids are either asked or will soon be called for, in Construction News, pp. 173 to 185, are the following:

Hotel, Hot Springs, Ark., Arlington Hotel Co., $2,225,000.

Apartment, New York, N. Y., Octo Building Corp., $1,500,000.

Dam, Little Rock, Ark., Arkansas Power Corp., $1,787,600.

Bridge, Portland, Ore., Comrs. Multnomah Co., $4,000,000.

Industrial Movements Shown by Commerce Dept. Figures

The Department of Commerce announces the following further figures covering industrial and commercial movements in July:

Total stocks of Lake Superior iron ore at the end of July, amounting to 27,503,000 tons registered an increase of 21 per cent over the inventory of June 30 and may be compared with the holdings on July 31, 1922, of 31,127,000 tons. Imports of iron and steel totaled 113,000 tons as against 72,000 in July, 1922, while the exports of iron and steel amounting to 141,000 tons, may be compared with 128,000 tons a year ago. Production of sheets by independent steel mills totaled 174,910 tons as against 218,432 tons in June and 179,100 in July, 1922. In terms of per cent to mill capacity the production of sheets amounted to 65 per cent as compared with 80 in June and 73 per cent in July a year ago. Unfilled orders for sheets on July 31 amounted to 404,868 tons as against 503,175 on June 30 and 409,885 on July 31, 1922.

A total of 551,000 employees was on the payrolls of representative New York State factories as compared with 555,000 for June and 490,000 for July, 1922. The index of employment in Wisconsin factories stood at 128 on July 15, based on the first quarter of 1915 as 100, as compared with 124 on June 15 and 107 on July 15, 1922. The average weekly earnings in New York State were computed at $27.54 for July as against $27.85 for June and $24.77 for July, 1922. For Wisconsin the index of weekly earnings was 209 for July 15 as compared with 226 for June 15 and 186 for July 15, 1922.

Bradstreet's index of wholesale prices at 139 for Aug. 1 may be compared with 142 for July 1, and 131 for Aug. 1, 1922. The index of retail food prices at 147 for July compares with 144 for June and 142 for July, 1922.

Weekly Construction Market

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the the issue of Sept. 6; the next, on Oct. 4.

Steel Products:	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Structural shapes, 100 lb.	$3.64	$4.00	$4.20	$3.40	$3.55	$4.20	$3.60	$4.10	$4.00
Structural rivets, 100 lb.	4.40	4.75	4.90	3.75	4.25	5.30	5.00	4.75	6.00
Reinforcing bars, ¾ in. up, 100 lb.	3.54	3.50	3.80	3.20	3.45	3.85	3.65	4.10	3.90
Steel pipe, black, 2½ to 6 in. lap, discount	44%	45%	43%	47%	53–5%	36%	33.2@42.2%	35%	47.42
Cast-iron pipe, 6 in. and over, ton	63.60	60.00	63.00	60.20	60.50	69.00	62.00	62.00	60.00
Concreting Material:									
Cement without bags, bbl.	2.70@2.80	3.00	2.25	2.20	2.50	2.84	2.63	2.90	2.25
Gravel, ¾ in., cu.yd.	1.75	1.90	2.38	2.00	1.85	1.90	2.15	1.25	1.50
Sand, cu.yd.	1.25	1.24	1.89	2.00	1.25	1.00	1.50	1.25	1.25
Crushed stone, ¾ in., cu.yd.	1.75	2.00	2.38	2.00	2.25	3.50	2.15	3.00	1.90
Miscellaneous:									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft.	61.00	—39.00	52.25	58.50	46.75	44.25	+42.00	29.00	70.00
Lime, finishing, hydrated, ton	18.20	22.50	20.00	20.00	25.50	24.00	22.00	24.00	21.00
Lime common, lump, per bbl.	3.00@3.25	1.50	1.75	1.50	1.50	2.70	2.10	2.80	10.00
Common brick, delivered, 1,000	23.65	11.00	13.10	11.00	17@19	12.00	15.00	13.00	16.50
Hollow building tile, 4x12x12, per block	Not used	.102	.115	.0724	.0816	.065	.....	.11	.115
Hollow partition tile 4x12x12, per block	.1263	.102	.115	.....	.....	.065	.108	.11	.....
Linseed oil, raw, 5 bbl. lots, gal.	.95	—.96	1.04	1.14	.99	1.09	—1.02	.86	1.22
Common Labor:									
Common labor, union, hour	.75	.35	.....	.....	.....	.50@.55	.55	.....	.....
Common labor, non-union, hour	....	.30	.30@.50	.82½	.50@.55	.35@.50	.50	.50@.62½	.35@.40

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given: 45-5% means a discount of 45 and 5 per cent. Charge is 15c. per 100 lb. for cutting reinforced steel into 2-ft. lengths or over.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b.

Labor—Concrete laborers' rate, 93½c.; building laborers (pick and shovel men) 75c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; common lump lime per 180-lb. net. Lumber delivered on job.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.80 for Kelly Island and $1.70 for Sheboygan. Common labor not organized.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered, in iron bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, size 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir, common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on pine lumber. Sand, stone, gravel and lump lime per ton. Cement, lime and tile are delivered; sand, gravel and stone on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 97.10). Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 3-in., $47.42; 6-in., $119.

Changes Since Last Week

Although price irregularities prevail in most commodities at present, with advances very nearly equalling declines, the construction materials market continues to retain that show of stability which has characterized it since the collapse of the "buyers strike" movement. Buyers are still cautious and the increased activity, particularly in iron and steel, that was expected to develop has not yet completely materialized.

Lumber shows increasingly firm tendencies, particularly in the West. Steel, lime, clay products and concreting materials fluctuate little.

Linseed oil, however, continues to decline. Raw oil dropped 2c. in Atlanta and 7c. per gal. in San Francisco during the week.

The iron and steel situation in brief: Pig-iron stocks accumulating; market weak. Iron and steel scrap adversely affected by weakness in pig iron. Fair volume of new buying in fabricated structural steel, particularly for schools and commercial buildings. Plate demand somewhat slower. Prices holding firmly to the $2.50 base for plates and shapes; bars, $2.40 per 100 lb., f.o.b. Pittsburgh.